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BRITISH COLUMBIA HYDROELECTRIC DEVELOPMENTS

DIESEL ENGINE PRACTICE.

BY. J. E. MEGSON AND H. S. JONES

REPORT ON COLUMBIA RIVER POWER PROJECT.

BY L. F. HARZA.

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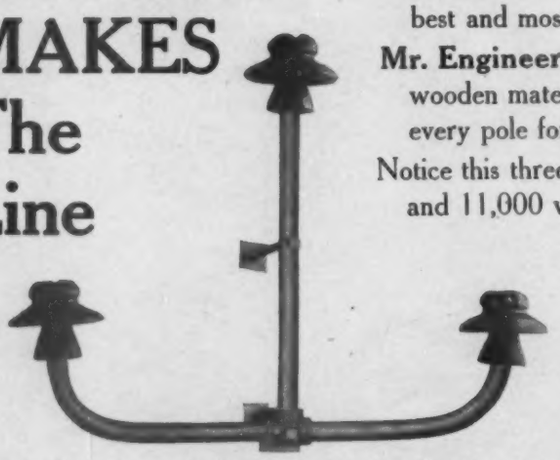

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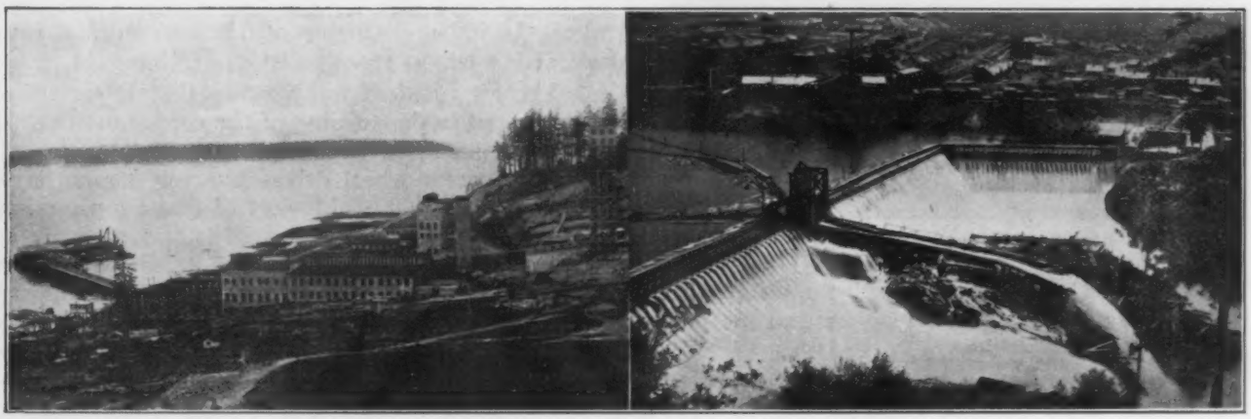


Powell River Development, showing Paper Mills, Dam and Intake.

BRITISH COLUMBIA HYDROELECTRIC DEVELOPMENTS

(Concluded.)

The Powell River Company, Ltd.

The situation of Powell Lake is particularly favorable for the development of a waterpower scheme. The lake is situated close to the sea coast; its original elevation before the construction of the works of the Powell River Company, Ltd., was 246 ft. above sea level; the area of the lake at this elevation is 65 square miles.

The Powell River Company, Ltd., completed the installation of a pulp mill plant at Powell River in 1911. The minimum flow of Powell River was insufficient for the power requirements of this plant, but by the construction of a concrete dam, the spillway of which is 270 ft. above sea level, sufficient storage was obtained.

A log sluice way is provided in the dam for the passage of logs over the dam, and guide booms to this sluice way are provided on the upstream side of the dam.

From the dam, water is conveyed to the turbines in the power house by means of three pipe lines. One of these pipe lines is of wood stave construction, the other two being of riveted steel.

The power house equipment consists of two 1875 k.v.a., 3-phase, 50-cycle, 600-volt Canadian General Electric generators, each direct driven at a speed of 375 r.p.m. by an Allis-Chalmers-Bullock turbine of 3000 h.p., and one 2500 k.v.a., 3-phase, 50-cycle. 600-volt. Canadian General Electric generator direct driven by a Platt turbine of 3500 h.p. This unit also runs at a speed of 375 revolutions per minute.

In addition to these hydroelectric units, turbines are used for driving the grinders. There are two sets of seven pulp grinders each driven by a pair of Allis-Chalmers turbines, the capacity of each of which is 1800 h.p. Two Platt turbines, each of 3600 h.p. are provided for driving other two groups of grinders, each of which is made up of five machines.

The Granby Consolidated Mining, Smelting & Power Company, Ltd.

The mining and smelting of copper is one of the principal industries of the Province of British Columbia. In 1894, the industry was practically non-existent; today more than 60 per cent of the copper exported from the Dominion is mined in British Columbia. The growth of the industry has been greatly assisted by cheap power supplied by the development of the water power resources of the Province.

The Granby Consolidated Mining, Smelting & Power Company, Ltd., has recently completed the hydroelectric development of Falls Creek to provide cheap power for the operation of its new copper mining and smelting plant at Anyox, B. C.

Storage is accomplished by a rock filled dam which was constructed with the crest at a maximum height of 115 ft. above the bed of the stream. In the dam, an opening 72 in. in diameter controlled by a sluice gate is provided, to which is connected a 72 in. wood

stave pipe 5817 ft. in length, the first 150 ft. of which is in tunnel. This wood stave pipe is under a maximum static head of 298 ft.; an open standpipe 12 in. in diameter is provided 4000 ft. from the intake. A steel pipe line 72 in. in diameter and about 120 ft. long provided with the necessary branches, connects the lower

Exterior of Granby Power House.

end of the wood stave pipe line with the water wheels in the power house. The working head at the power house is 375 ft.

The power house is a steel frame structure with brick curtain walls built on concrete foundations; it is 180 feet long and 50 ft. wide, and contains five machines direct driven by water wheels for supplying air at various pressures for this operation of the mine and smelter, together with water wheel driven electrical units.

The electrical equipment consists of two 938 k.v.a., 3-phase, 60-cycle, 2200-volt Westinghouse generators running at 400 revolutions per minute. Each unit is provided with two water wheel runners which are directly overhung upon the main drive shaft which is extended at either end beyond the bearings for this purpose. At the present time, either of the two generators is of sufficient capacity for the entire electrical load, so that one of the units may be shut down for repairs without interrupting the electrical service. For the excitation of the generators, two 50-kw., 125-volt, 850 revolutions per minute, Westinghouse exciter sets are provided.

For supplying power to the electric locomotives used for haulage, and for other direct current motors, two Westinghouse motor generator sets are provided; each of these consists of a 440 h.p., 2200-volt, 3-phase, 60-cycle induction motor direct connected to a 300 kw., 550-volt interpole direct current generator running at 850 revolutions per minute.

Two 42-ton Baldwin-Westinghouse electric locomotives are used for hauling ore from the mine to the smelter, and for hauling freight from the wharf to the plant; each of these locomotives is provided with four motors aggregating 336 h.p., and has a starting tractive effort of 28,000 lb.

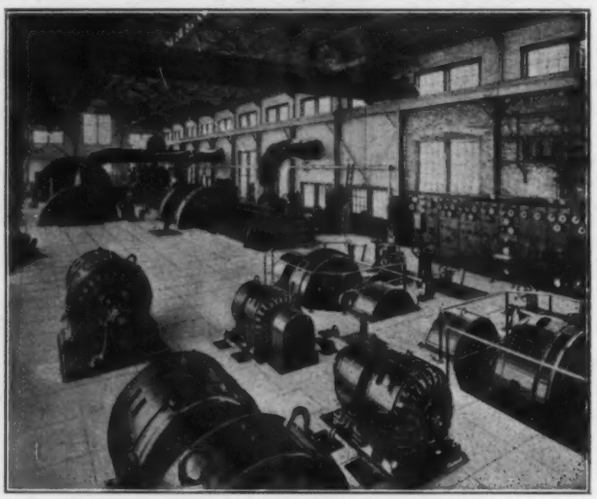
For smelter charge service three 12-ton Baldwin-Westinghouse electric locomotives are used, and four 6-ton locomotives are used for mine haulage.

Alternating current is transmitted to the mine at 2200 volts; the motors on the crushers, and all other large motors are operated from the 2200 volt circuit. The small motors operate at 220 volts.

A 16-panel switchboard is provided in the power house for controlling the generators and the various power circuits; this switchboard, together with the rest of the electrical apparatus, was supplied by the Canadian Westinghouse Company.

The air supply for the main blast furnace and the smelter is supplied by three Connersville positive blowers, each of which has a capacity for delivering 40,000 cubic feet of free air per minute against a pressure of 32 ounces and operating at a speed of 115 revolutions per minute. Each of these blowers is operated by means of a direct connected Pelton Doble water wheel, 14 ft. in diameter of 625 h. p. normal rating and with a maximum capacity of 775 h.p.

The air required for blowing the Bessemer converters used in the refining of the copper matte at the smelter is provided by a Nordberg variable capacity two-stage water wheel driven blowing engine having a capacity of 12,000 cubic feet of free air per minute under a maximum pressure of 18 lb. per sq. in. and operating at a speed of 75 revolutions per minute. This blowing engine has directly mounted upon its crank shaft, a Pelton Doble water wheel 25 ft. in diameter; this water wheel, in addition to supplying power for driving the blowing engine, furnishes the necessary



Interior of Granby Power House.

flywheel effect to insure smooth operation. The blowing engine is of the reciprocating type and the maximum capacity of the water wheel is 1400 h.p.

For supplying compressed air for the operation of tools at the mine and elsewhere on the property, a Nordberg two-stage air compressor of the reciprocating type is provided; this compressor has a capacity for delivering 4000 cu. ft. of free air per minute at a pressure of 100 lb. per sq. in. and operating at a normal speed of 84 revolutions per minute. This compressor is direct driven by a Pelton Doble water wheel 16 ft. in diameter and designed for an output of 800 h.p. The water wheel runner also provides the necessary flywheel effect.

Kootenay River Development of the City of Nelson.

At Upper Bonnington Falls on the Kootenay River the City of Nelson has installed a hydroelectric power plant which provides light and power for the city and for mining purposes in the surrounding district.

The installation consists of one 750 k.v.a. and one 1000 k.v.a., Allis-Chalmers, 3-phase generators, each driven direct by one 2000 h.p. Allis-Chalmers turbine; the speed regulation is controlled by an Allis-Chalmers oil pressure governor. The head available at the turbines varies from 40 ft. to 60 ft. depending on the stage of the river.

Current is transmitted at 12,000 volts from the power house to Nelson, a distance of 10 miles, over a 2 circuit transmission line; these circuits consist of stranded aluminum cable and are carried on cedar poles.

Barriere River Development of the City of Kamloops.

The City of Kamloops, situated at the junction of the North and South Thompson Rivers, has recently completed the first portion of the hydroelectric development of the Barriere River, a tributary of the North Thompson River, to provide cheap light and power for the city, and to encourage settlement in the valley of the North Thompson, where the land is suitable for extensive farming provided cheap power for pumping water for irrigation is available.

Barriere Hydroelectric Generating Station.

To provide the necessary storage a dam was built at the outlet of Barriere Lake; from this point water is conveyed to the forebay through a flume 18,000 ft. in length; from this forebay, which is fitted with sluice gates and provided with a spillway, the water is conducted through pipe lines to the power house, which is situated on the north bank of the Barriere River.

The equipment in the power house consists of the Francis turbines manufactured by the Platt Iron Works, and operating under a head of 190 ft. each of which drives a 750 k.v.a. generator of the 3-phase, 60-cycle type which generate current at 2300 volts.

The necessary high and low tension switching equipment is provided in the power house, together with transformers which step up the voltage to 44,000 volts, at which voltage it is transmitted over a transmission line about 40 miles in length to the City of Kamloops; the voltage is transformed down at a substation which forms portion of the auxiliary steam turbine plant building. This steam plant has recently been completed and is intended for emergency purposes only. The pumping plant for the city water system is also housed in this building. All of the electrical equipment was supplied by the Canadian Westinghouse Company.

The power house has been constructed of sufficient size for the accommodation of two additional units which will be added to as the load increases. The ultimate capacity of the development is 20,000 h.p.

The cost of the initial hydroelectric installation is about $140 per h.p.; the installation of further 4000 h.p. will reduce the average cost per housepower to $90; it is estimated that when the ultimate development is carried out the average cost per horsepower will be reduced to $80.

The Hedley Gold Mining Company.

The Hedley Gold Mining Company's hydroelectric developments on the Similkameen River provide light and power for the operation of motors at the mines, and for compressors, crushers, stamps, vanners, pumps and various other machines in the stamp mill and cyanide plant where the gold ore is treated; direct current is also provided for electric locomotives. There are two separate power houses in connection with this development.

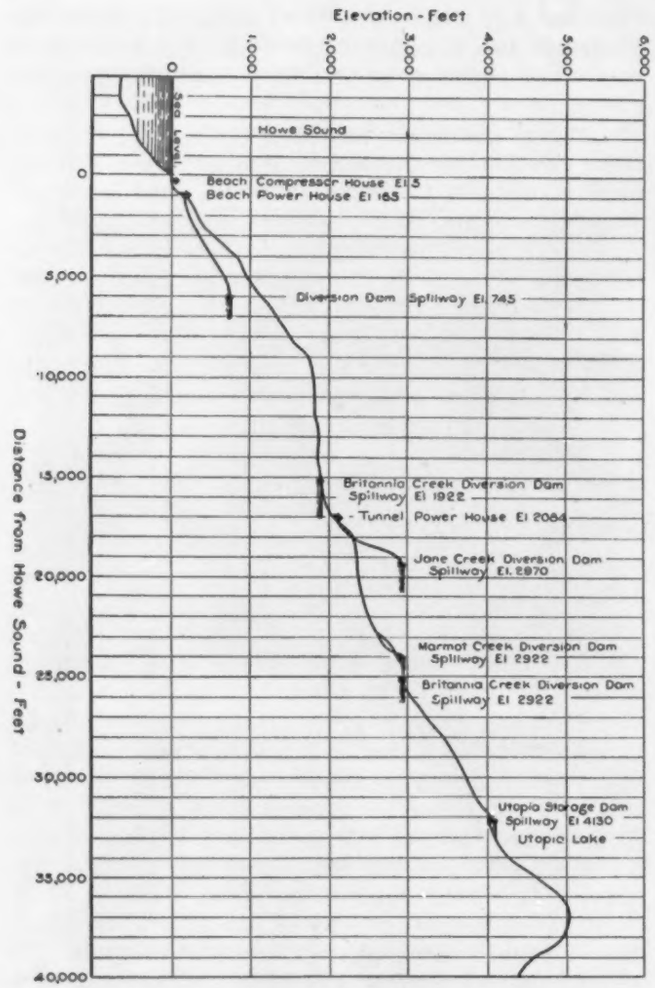
Water for Plant No. 1 is diverted from the Similkameen River by means of a diversion dam formed of stop-logs supported by concrete piers. From the diversion dam, the water is conveyed through 16,000 ft. of flume 9 ft. wide and 7 ft. deep to a forebay, thence through a steel pipe line 8 ft. in diameter to the power house. The static head of the power house is 67 ft.

The equipment consists of one 1250 k.v.a. Canadian Westinghouse 3-phase, 60-cycle, 6600-volt, 400 revolutions per minute, generator (with direct connected 25 kw. exciter) coupled to a 2100 h.p. S. Morgan Smith turbine of the Francis type; standard generator and exciter switchboard panels are provided. Current is transmitted at 6600 volts to the mill 3½ miles distant, where the voltage is stepped down to 2200 volts to enable the two plants to be run in parallel.

Plant No. 2 operates under a head of 412 ft. About 3 miles from Hedley, a dam is constructed which diverts water to a flume about 4 ft. wide and 4 ft. deep and about 13,000 ft. in length to a forebay; from this point, the water is taken to the power house through a steel pipe line 20 inches in diameter to a 550 h.p. Doble water wheel driving a direct Canadian Westinghouse 400 k.v.a., 3-phase, 60 cycle, 2200 volt, generator at a speed of 150 revolutions per minute. A second 20-inch pipe line supplies water to a Knight water wheel driving a Canadian Ingersoll-Rand air compressor of capacity 3000 cu. ft. of free air per minute.

The Britannia Mining and Smelting Company, Ltd.

The property of the Britannia Mining & Smelting Company is situated at Britannia Beach on the east shore of Howe Sound about 28 miles from the City of Vancouver, B. C. To provide light and power for the operation of the haulage and compressed air systems at the mine, and for the motors and lighting at the reduction mill and throughout the camp, a hydroelectric system has been developed comprising a compressor plant built on the foreshore of Howe Sound, 5 ft. above sea level, and two hydroelectric generating stations, named the Beach Power House and the Tun-



Profile of Water Power Development Brittania Mining & Smelting Co., Ltd.

nel Power House, and situated 155 ft. and 2050 ft. above sea level, respectively. The water power available on the property has now been developed nearly to its ultimate capacity. It has, therefore, been found necessary to install one 500 k.v.a. steam turbine unit, and the installation of one 2000 k.v.a. steam turbine unit is now in progress.

The Tunnel Power House is situated about three miles from the Beach Power House at elevation 2050. The power house is a frame building 40 ft. wide and 83 ft. long, and the equipment is as follows: One 200 kw., 3-phase, 60-cycle, 900 r.p.m., 6600-volt, Allis-Chalmers generator driven direct by one 330 h.p. Pelton Doble water wheel. For excitation purposes, one 6½ kw., 125-volt exciter is belted to the unit. One 100 kw., 3-phase, 60-cycle, 900 r.p.m., 6600-volt, Allis-Chalmers generator, driven direct by one 130 h.p. Pelton Doble water wheel. For excitation purposes, one 6½ kw., 125-volt exciter is belted to the unit. One 40 kw. Westinghouse d.c. generator, 675 r.p.m., generating current at 250 volts, direct driven by one 60 h.p. Pelton Doble water wheel, for trolley traction purposes. One air compressor, capacity 700 cubic feet per minute, speed 120 r.p.m., belt driven by one Pelton Doble water wheel of 125 h.p. One air compressor, capacity 1100 cubic feet per minute, speed 180 r.p.m., belt driven by one 200 h.p. Henry water wheel.

The Beach power house is a frame building 30 ft. wide and 81 ft. long, built on concrete foundations, the elevation of the floor being 155 ft. above sea level. The power house was built at this elevation in order that some of the water from the tailrace might be available for use in the reduction mill, the new section of which is immediately in front of the power house. The water, on emerging from the tailrace of the tunnel power house, enters a 24 in. wood stave pipe line 1800 ft. in length, through which the tail water is conveyed to a point in the bed of Britannia Creek, where a diverting dam is situated; from this intake, water is conveyed with the upper end of a 12 in. "extra heavy" lap welded steel pipe 7900 ft. long. The static head on this pipe line at the Beach Power house is 1765 ft. The following machines in the Beach power house are supplied with water from this pipe line:

Two 200 kw., 3-phase, 60-cycle, 600 r.p.m., 6600 volts, Westinghouse generators driven direct by 330 h.p. Pelton water wheels. To each of these machines is belted a 17 kw., 250-volt exciter.

One 200 kw., 3-phase, 60-cycle, 600 r.p.m. 6600-volt Allis-Chalmers generator, driven direct by one 330 h.p. Pelton water wheel. To this machine is belted one 6½ kw., 125-volt exciter.

In connection with the Beach power house, a second independent pipe line has been installed. The intake is on a unnamed stream, the spillway of the diverting dam being at elevation 750. The water is conveyed from this point to the Beach power house through 18 in. wood stave pipe and 15 in. "extra heavy" lap welded steel pipe, the combined length of which is about 3000 ft. Water is supplied by this pipe line to one Pelton Doble water wheel driving direct one 150 kw., 250-volt, d.c. Crocker-Wheeler generator. Coupled to this unit is a 150 h.p., 220-volt induction motor. This motor will be used to drive the generator, should the water supply become insufficient for the entire plant.

The Tunnel power house and the Beach power house are connected by a wood pole single circuit transmission line, consisting of three No. 2 copper wires, and the generators of the two plants are run in parallel. This transmission line is extended to Britannia Mine at elevation 3500, with No. 6 wire, and to the Beach compressor house with No. 2 wire. At Britannia Mine, four 50 k.v.a., 6600/220-volt oil insulated, self cooled transformers are installed to provide current at 220 volts for induction motors operating crushers, and for two motor generator sets of 40 and 45 kw. capacity, which provide d.c. current at 250 volts for trolley traction purposes. Two 50 k.v.a. 6600/400-volt transformers are provided for the operation of an electric hoist. Pole type transformers of a total capacity of 25 kw. are installed at the mine for lighting.

Within the Beach compressor house are installed 6 150 k.v.a., 6600/220-volt oil insulated self-cooled transformers to provide current at 220 volts for the operation of motors in the reduction mill, machine shop, etc., and for all a.c. power required at the Beach Camp. In addition, pole type transformers are installed throughout the camp for lighting purposes.

The total capacity of induction motors connected to the system amounts to 1268 h.p., and transformers

aggregating 1847 k.v.a. are installed. Mining is carried on with three 8-hour shifts, and the reduction mill is operated continuously; the load factor is very nearly 100 per cent. A very complete telephone system is provided.

City of Prince Rupert.

The City of Prince Rupert has undertaken the development of Woodworth Lake water for power purposes, in conjunction with the extension of the water supply.

Woodworth Lake is situated about 7 miles from Prince Rupert, and has an area of 500 acres; the mean runoff available for the city's use at the present time is 75 cu. ft. per second; additional water records aggregating 10,000 horsepower have been secured for future extensions. To utilize the runoff from Woodworth Lake watershed, a storage dam at Woodworth Lake, 35 ft. in height was built. A suitable power house was found about 7500 ft. from the Lake, giving a head of 330 ft. at the power house.

The initial installation consists of one 1125 k.v.a. 3-phase, 60-cycle, 4400 volts Canadian General Electric generator driven at a speed of 514 revolutions per minute by a water wheel of 1650 h.p. capacity. The requisite flywheel effect is provided by a cast steel flywheel weighing 8000 lb., and a governor operated by oil pressure ensures close regulation. For excitation purposes, a 15 kw. direct current generator connected to the main unit is provided. The voltage is regulated by a Tirrill regulator. The generator and outgoing line are controlled from a 3-panel switchboard.

Water is supplied to the unit from Woodworth Lake through a pipe line 45 in. in diameter and 7800 ft. long. This pipe line is partly used for water supply purposes.

Energy is transmitted to the city over a single circuit wood pole transmission line.

Work was commenced in January, 1914, and the plant was placed in operation in November, 1914, since when it has been in continuous operation; it has given entire satisfaction.

Swanson Bay Forests, Wood Pulp & Lumber Mills, Ltd.

The plant of the Swanson Bay Forests, Wood Pulp & Lumber Mills, Ltd., is favorably situated on Swanson Bay about 130 miles south of the City of Prince Rupert; it comprises a sulphite pulp mill, a large sawmill and wharves suitable for loading and unloading large vessels. Power is provided for the operation of some of the machinery by turbines aggregating 1250 h.p. operating under a head of 132 ft. A diversion dam has been built on Swanson Creek and from this point the water is conveyed to the turbines through a pipe line. The turbines were supplied by the S. Morgan Smith Company. The ultimate capacity of the plant is about 12,000 h.p.

Revelstoke Development on the Illicilliwaet River.

The hydroelectric development of the City of Revelstoke is on the Illicilliwaet River. A concrete dam across the canyon enables a head of 72 ft. to be obtained at the power house about 800 ft. down stream from the dam. Within the power house are installed two units supplied by wood stave pipes, the intakes of which are controlled by sluicegates in the dam.

The first unit consists of a 450 k.v.a. Canadian Westinghouse generator driven by a 900 h.p. Francis turbine at a speed of 450 revolutions per minute. The second unit is made up of a 750 k.v.a., 360 revolutions per minute, Canadian Westinghouse generator direct connected to a 1400 h.p. Escher-Wyss turbine of the Francis type, with double discharge; speed regulation is controlled by an oil pressure governor. Exciter units are in each case direct connected to their respective generators.

These units generate 3-phase, 60-cycle current at 2300 volts for use in the City of Revelstoke, and for the shops of the Canadian Pacific Railway Company.

Hydroelectric Development on Juniper Creek at Skeena Crossing.

In connection with the development of a high grade copper proposition owned by the Rocher de Boule Copper Company, and which is under lease to the Montana Continental Development Company, a small hydroelectric plant has been installed on Juniper Creek about 4½ miles from Skeena Crossing.

A 187.5 k.v.a. Canadian General Electric 3-phase, 60-cycle, 2300-volt generator, belt driven by a Pelton-Doble water wheel has been installed.

Water is obtained from an intake on Juniper Creek and is conducted to the power house through a wood stave pipe line 3783 ft. in length, made up of 1000 ft. of 24 in. pipe, 1000 ft. of 22 in. pipe, 1000 ft. of 20 in. pipe, and 783 ft. of 18 in. pipe. The maximum heads on these pipes are respectively 50 ft., 100 ft., 150 ft. and 212 ft. The effective head at the water wheel nozzles when the unit is operating under full head is 178 ft.

Fortunes Creek Development at Armstrong.

The municipality of Armstrong owns and operates a hydroelectric plant on Fortunes Creek which provides light and power for the City of Armstrong. The water supply of the city is also obtained from this creek.

Fortunes Creek is a stream about 15 miles long, rising in the hills northeast of Armstrong at an elevation of 3500 ft., and discharging into the Shuswap River. The flow of the stream is variable, and for three months in the year the discharge is so small that an auxiliary Diesel engine set is used to provide the necessary power during these months.

A timber crib diverting dam forms an intake for a wood stave pipe line which is joined to a 10 in. steel pipe line at the top of the cliff behind the power house.

The equipment consists of a 100 kw. Canadian Electric generator driven direct at a speed of 900 revolutions per minute by a 150 h.p. Pelton water wheel. The Diesel engine set consists of a 200 h.p. Diesel engine driving a 125 kw. generator. Both units are of the 3-phase, 60-cycle type and generate current at 2300 volts. A three-panel switchboard is provided for controlling the power house equipment.

Hydroelectric Development on Murray Creek, Near Spence's Bridge.

Murray Creek is a small stream which rises in the Murray Mountains at an elevation of 4000 ft. above sea level, and flows southeast discharging into the Thompson River at Spence's Bridge at an elevation of 700 ft.; it is about 10 miles in length. The precipitation over the watershed does not exceed 20 in.

About a quarter of a mile from the mouth of this

creek there is a fall over 200 ft. in height; at the crest of this fall a small timber dam has been constructed which diverts the water from the stream into a tunnel 200 ft. in length. To the lower end of this tunnel a pipe line 10 in. in diameter is connected, which conveys water to the power house.

The power house is a concrete building 34 ft. in length and 24 ft. wide; the static head at the power house is 255 ft. The generating machinery within the power house consists of a 75 kw., 6 pole, single-phase alternator running at 200 revolutions per minute, which is belt driven by a Pelton water wheel running at 250 revolutions per minute.

The energy is transmitted to Spence's Bridge, a distance of about three-quarters of a mile, at 7500 volts, and is there transformed down to 110 volts for lighting purposes.

Hydroelectric Development at Glacier.

The waters of the Illicilliwaet River are also used at a small hydroelectric installation at Glacier, the electric energy being used for lighting the Canadian Pacific Railway Hotel at that point on its transcontinental line.

The power house is a frame building 21 ft. long by 17 ft. wide, and provides accommodation for two 25 kw., 125-volt generators, each of which is belt-driven by a turbine of 50 h.p. at a speed of 1050 revolutions per minute. The head utilized is 90 ft. Current is transmitted to the hotel over a transmission line 1800 ft. long.

Water Power Development at Field.

The mill of the Mount Steven Mining Syndicate is operated by power derived from the development of Cathedral Creek, a small tributary of the Kicking Horse River near Field, B. C., on the main line of the Canadian Pacific Railway.

A small diverting dam 9 ft. high provides an intake for a wood stave pipe line 12 in. in diameter and 1700 ft. in length, which delivers water to a 100 h.p. Pelton water wheel under a head of 300 ft. The main shaft in the mill is driven from a pulley 36 in. in diameter on the water wheel shaft.

Prior to the installation of this water wheel, steam power was used to drive the mill machinery, and it has been found that a very great reduction in operating expenses has been made since the water wheel was installed.

Nass River Development of the Kincolith Packing Company, at Mill Bay.

The Kincolith Packing Company owns and operates a cannery at Mill Bay in Northern British Columbia, and to provide power for the operation of this cannery during the fishing season a small water power development utilizing the waters of Nass River has been constructed.

The Nass River is fed by three small lakes at an elevation of about 360 ft. above sea level. An 18 ft. dam has been constructed at the outlet of one of these lakes, and a 10 ft. dam at the outlet of the lake nearest the cannery.

The water wheel equipment consists of three Pelton water wheels, each of about 30 h.p. capacity, and one 90 h.p. Pelton water wheel. The length of the pipe line between the intake and the cannery is about 2000 ft.; the static head at the water wheels is about 330 ft.

DIESEL ENGINE PRACTICE.

BY J. E. MEGSON AND H. S. JONES.

Care and Operation of Earlier Types of Engines.

(Concluded.)

The casting which contains the fuel needle and the other accessories to the fuel valve is known as the fuel cage. This cage is an iron casting which is subjected to high pressure. The high pressure in this valve is confined in the steel bushing which is pressed into the casting. The injection air and fuel oil connections are both screwed into steel bushings. Water circulated around the bushings keeps it cool and prevents overheating of the fuel oil. The fuel needle is made of a special alloy with a cast iron spring case on the outer end in which the spring operates to close the valve against the action of the fuel cam.

The best quality of woven vulcabeston, or similar material, should be used for packing the fuel needle stuffing box; the packing must contain no rubber or gutta percha, as oil quickly softens and destroys these materials.

The atomizer where the injection air and fuel oil meet before entering the cylinder must be frequently examined to see that it is not clogged with dirt, which may come in the oil, or scale from the pipes. As a precaution against the clogging of the atomizer keep the oil strainer clean. The fuel needle seat should show a ring all around about 1/32 in. wide and should not require grinding very often. A reamer and guide should be on hand to ream this seat when necessary, and great care must be taken to apply an even pressure to the reamer to prevent chatter marks which would spoil the seat. To prevent undue wearing of the needle withdraw it once a week and oil the packing with graphite and cylinder oil applied by means of a rag on a wire. The needle may readily be withdrawn after loosening the gland nuts.

The exhaust valve seats in some engines are not removable. It may be reamed when necessary, using the guide furnished with the reamer which fits into the head. Care must be exercised to cut as little as possible from the seat and to maintain an equal pressure on the reamer to insure a true and smooth surface. When the valve needs refacing it should be put into a lathe and skimmed off by a competent man, removing no more material than necessary to true up the face and maintain an angle of 45 degrees.

It is the writer's opinion that all Diesels should be provided with a safety valve on each working cylinder. This valve is intended to relieve any undue pressure in the cylinder and is set to open at 800 lb. per sq. in. The piston traveling slowly downward at the time the first ignition takes place allows the pressure to increase above the normal; the relief valve is intended to take care of this increased pressure. Also in case needle should stick open and allow the fuel to enter the cylinder during the compression stroke a premature ignition will occur, this increased pressure causing the relief valve to pop and give warning that the fuel needle is sticking.

The fuel pump consists in general of fuel plungers, suction valves and discharge valves, together with their driving and controlling mechanism. The plungers are driven by eccentrics and are attached to the suction valve mechanism by means of connecting rods

and eccentric levers. Oil is delivered to the chamber in which the plunger travels through a mechanically operated suction valve. The plunger in its turn delivers the oil through the discharge valve to the fuel valve on the engine cylinder. The opening of the suction valve is controlled by an eccentric fulcrum, the position of which is regulated by a governor according to the load on the engine. At full load the suction valve starts to open at about mid-position of the plunger on its downward suction stroke and closes about mid-position on the upward delivery stroke. At no load the suction valve remains open during complete upward stroke of the plunger. The fuel pump suction valve is made of steel and the valve stems are nickel steel. The stuffing boxes of these valves should be packed with Blackhawk or similar packing, just tightly enough to prevent leakage as excessive friction prevents the springs from closing the valves promptly and affects the regulation of the engine.

Careful straining of the fuel oil is an important factor in the successful operation of these valves. Dirt or scale may mar the seats sufficiently to affect the operation of the engine. In case of such injury to a suction valve the seat should be reamed with a tool provided for this purpose and the valve trued up in a good lathe by a careful workman. The valve should then be ground in the seat with very fine emery and finished with pumice stone.

When replacing the valve cage after having cleaned all parts of the valve, be sure to get the lower joint tight, otherwise no oil will be delivered to the fuel value and no work done in the cylinder. This joint is made with a corrugated brass gasket. Both surfaces of the joint must be thoroughly cleaned and the hole in the gasket must be large enough not to interfere with the operation of the valve.

The fuel pump discharge valves usually consist of hardened steel balls in steel cages. When the fuel oil is thoroughly strained and contains no grit, these valves require little attention. Should they become worn the seats must be reamed and a new ball put in place. To seat the new ball only one solid tap of a hammer is necessary. A ball set should be used for this work, using the guide which comes with the reamer as a guide for the ball set. The ball set is made of brass or steel with a brass tip so that the ball will not be marred. The lift of the ball should not be greater than 1/16 in. When it becomes greater than this, due to wear or reaming of the valve seat, it is necessary to use a new cage. Test the discharge valve to know that it is tight. To do this, disconnect the supply pipe between the discharge valve and the fuel valve. Place a cage on the outlet of the discharge valve and operate the fuel pump by hand to obtain a pressure of 75 atmospheres on the cage. If the pressure does not remain constant, look for a leak in the gasket, the discharge valve or the suction valve.

The injection air pressure should be graduated according to the load. At half load, and under, it should range from 50 to 60 atmospheres, or 450 lb. to 900 lb. per sq. in. Above half load from 65 to 70 atmospheres, 975 to 1050 lb. per sq. in. It is desirable when the peak of the load runs over the rated load of the engine, to use 75 atmospheres, 1125 lb. per sq. in. If this pressure is too low for the load of the engine the exhaust will smoke. If it is too high the engine will knock. The pressure of 75 atmospheres is absolutely safe, as all high pressure fittings furnished are tested to a pressure of 3000 lb., the valves to 2500 lb. and the tubing to 6000 lb. The gauges which indicate the injection pressure should be frequently calibrated.

In every engine room there should be one gauge fitted with a valve and this valve kept closed. This gauge may then be used at any time for comparison with others. By holding one gauge in reserve the others may frequently be checked and when found incorrect, easily adjusted. A sudden increase or decrease of pressure often causes a gauge to read incorrectly. To positively check gauges for correctness they should, say every six months, be tested by means of a gauge tester. Gauges in use for some time tend to read high and lack of air pressure will make the engine appear overloaded.

The cylinders of practically all Diesel engines are lubricated by force feeding. The lubricating pump in some types is driven from the end of the cam shaft and must always receive proper care. The connecting rod boxes, shaft bearings, cam rollers and all wearing surfaces enclosed in the crank case are kept well oiled by the splash or forced lubrication. In splash lubrication the oil is thrown by the crank and conveyed to the various parts by oil grooves and oil holes designed for the purpose.

The oil cups on the fuel pump and governor must be kept well filled. No lubrication is necessary for the admission or exhaust valves, but the admission valve dash pot should occasionally be oiled. Where splash lubrication is employed three or four pints of oil should be added every four hours to crank pits. Three or four bucketsful of water should also be added to crank pits at this time. Some engines will evaporate more water than others. The engineer should use his judgment in order to keep the level in the crank case about right.

It is of the utmost importance that the fuel valve be correctly timed, that is, that it opens to admit fuel at the proper time and closes at the correct moment after the fuel is all injected. Every Diesel engine builder will furnish with his engine a table giving the correct measurements for his special engine. A typical diagram is shown in Fig. 10. If the fuel valve opens too early the pressure in the cylinder will increase. This condition should be avoided as it causes excessive wear of the engine bearings without increasing the engine capacity. Do not increase the lead beyond that given in the table, with the idea of forcing the engine to pull more load. The figures given are sufficient and if the engine will not pull its rated load when adjusted correctly look elsewhere for the trouble. If the fuel valve opens too late difficulty may be encountered in pulling the rated load. If the fuel valve closes too early the engine may have a smoky exhaust and burn too much fuel for the load which it is running. If the fuel valve closes too late injection air will be wasted. When setting the fuel valve compressed air in the air storage bottle should be used to indicate the exact time of the opening of the needle. To ascertain the point of opening this valve proceed as follows:

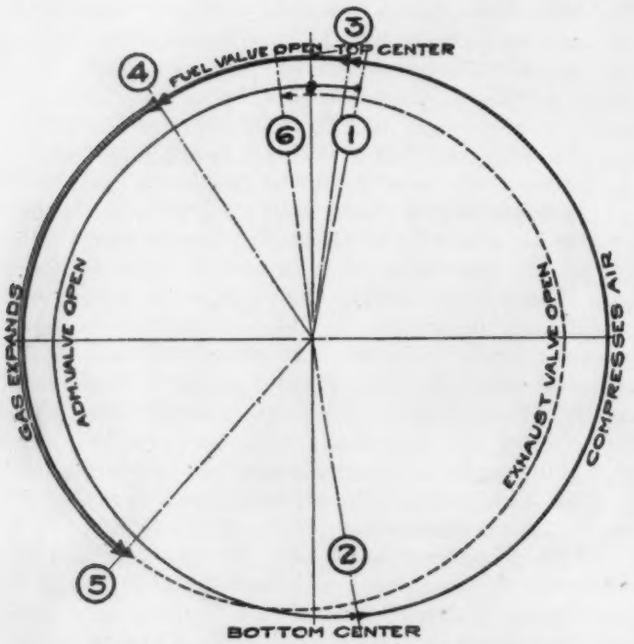


Fig. 10. Typical Valve Timing Diagram.

By barring the fly wheel, set the engine a few inches back of the position at which the valve should open. Pull up lever that relieves the compression on the cylinder or take out the indicator plug. Then turn the fly wheel ahead until the required lead is reached, whether it be 2½ or 5 inches or more before the dead center-mark on the wheel when set at the proper measurement according to your table for the lead; turn on the injection air and listen at the indicator hole for a leak by the needle into the cylinder. If you hear nothing, change the adjustment of the valve rod until you just hear the least bit of air blowing by. Be very careful about this adjustment and see that the blow is the same after you have regulated your adjustment.

To ascertain the point of closing of the fuel valve turn the fly wheel ahead slowly until no air is heard to escape from the fuel valve when valve on the air line is open. Determine the point of closing by measuring from this point to dead center position. If the correct opening and closing of this valve cannot be accomplished by adjusting the vertical push rod it is then necessary to move the fuel cam nose slightly forward or backward, as the case may be, in the cam body. When the fuel nose is in its correct position any space between the ends of same and the fuel cam body should be carefully and tightly filled with metal shims to insure the nose remaining securely in its place. It is good policy to check the timing of these valves at least once a month. Always check and properly time these valves after a fuel needle or atomizer has been removed or reground, and also at any time that it has been found necessary to take the needle out or to remove the valve cage.

There are quite a number of differently designed Diesel engines at this time and no doubt the number will increase rapidly, due to the number of manufacturers going into the Diesel engine building, but all true Diesels work along the same lines. Some are horizontal and some vertical, but the timing of the valves is practically the same. Some of the latest designs have all valves in the top of the head. This type of engine does not require as high a spray pressure as some of the others, air pressure ranging from 40 to 65 atmospheres, 600 to 975 lb. per sq. in., according to the load.

To remove sediment from the bottom of a boiler the blow-off valve should be slowly opened wide in the morning or before the circulation has started. After a few moments it should be closed slowly so as to avoid shocks from water-hammer.

The patent office, for the first time in years, has disposed of as many applications as were received. On June 30, 1914, there were 22,283 applications waiting action, and on June 30, 1915, there were 18,270. The number of patents granted in 1914 was 38,225; in 1915 the number was 44,402.

An electric condenser consists of two conductors separated by a non-conductor. Its ability to retain a certain quantity of eletricity is known as its capacitance, and depends upon the area of the conductors, the distance between them and the nature of the non-conductor or dielectric. In mechanical terms the effect of capacitance corresponds to inertia. Condensers are extensively used in telephone apparatus and condenser phenomena are met in long-distance, high-tension transmission or in cable distribution.

A steam condenser is an apparatus whereby exhaust steam from a turbine or engine is cooled and converted into water. A jet condenser is used where the supply of cooling water is limited, the water being allowed to mix directly with the steam. A surface condenser is used when the supply of cooling water is large and water for steaming purposes small, the cooling water passing around pipes through which the exhaust steam circulates. The condensed steam is then pumped to the hotwell so as to be used again

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Slide-rule solutions of quadratic equations can be quickly accomplished by first reducing the equation to the form $x^2 + bx + c = 0$, in which **b** and **c** are any positive or negative real numbers. Set the hair-line of the slide-rule runner over **c** on the D scale. Then move the slide and mentally add the readings on the C and D scales until the slide is in such a position that the algebraic sum of the readings is equal to **b**. These readings are the required roots. Thus in the equation $x^2 + 3.97x + 3.85$, set the hair-line over 3.85 on the D scale. When the left index of the slide reads 1.5 on the D scale, the hair-line reading on the C scale is 2.565, their sum being 4.065. When the index reads 1.9, the hair-line reads 2.025, and the sum is 3.925. The first sum is greater and the second is less than **b**, which should be 3.97. The proper position of the slide index must therefore be between the two. Moving the slide back toward the first position and watching the variation in the sum of the two readings, we come to the index setting of 1.68 on the D scale and the hair-line reading of 2.29 on the C scale, their sum being 3.97 or **b**.

REPORT ON COLUMBIA RIVER POWER PROJECT.

BY L. F. HARZA.

Appendix D. Available Head as Limited by Backwater Conditions.

Limiting conditions. The practicable limit to which the headwater of a power station can be raised is sometimes determined by the height of the banks of the stream or other topographical features at the damsite, sometimes by the relation of the height of dam to its economy or feasibility, at other times by the elevation of some bench suitable for a canal location, but still more often perhaps by property damages from overflowed areas upstream from the dam, or by a combination of any or all of the above. In the case of this project the last named influence is very important and will receive first consideration.

Relation of Head to Railroads. Fig. 1 (p. 377, Journal of Electricity, Power and Gas, Nov. 13, 1915) is an outline map of the river from The Dalles eastward to the limit of any important backwater influence, showing towns and railroads. Two trans-continental railroads follow the banks of the river from Portland eastward past our damsite and some 130 miles or more above. The Oregon-Washington Railroad & Navigation Company's main line, on the south or Oregon shore of the river, was built in 1881 and 1882; the Spokane, Portland & Seattle Railroad, on the north or Washington shore, owned jointly by the Northern Pacific and Great Northern lines, was built in 1905 to 1907.

The O-W. R. & N. was thus constructed prior to the record flood of 1894 and was in reality submerged by this flood through many miles of its length. A considerable portion was washed out at this time, from the damsite upstream toward Umatilla and also at places below the damsite toward Portland, and was entirely out of service for several months during, and subsequent to this flood. The company was at this time in the hands of a receiver and the immense burden imposed upon it by the necessity of reconstruction caused it to be rebuilt in the cheapest possible manner by following the physical standards of the original railroad. Since that time many improvements have been made in alignment, and the line has been double-tracked from The Dalles eastward to Biggs and graded for double track still further eastward. As a result of these improvements, however, the road has been raised in grade but little, so that in case of a repetition of the 1894 flood it would still be submerged for many miles.

The S. P. & S. was built with reference to elevations established by this flood. It is a single track road of high physical standard without adverse grade and with a maximum grade of 0.2 per cent compensated 0.04 per cent for curvature, and with maximum curvature of 3 per cent between Portland and Pasco.

Fig. 5 (p. 377, Journal of Electricity, Power and Gas, Nov. 13, 1915) shows the sub-grade profiles of both railroads from The Dalles eastward about 43 miles, also the profiles of low water, of the 1894 floods, and of the Celilo Canal. It will be noted that upstream from the damsite the O-W. R. & N. is high for about four miles and from there upward is below the elevation of the 1894 flood to above Squally Hook Rapids, some 27 miles, while the S. P. & S. railroad would have been submerged nowhere.

Importance of extreme flood. The head and power capacity assumed to be available at any power site depend to a considerable extent upon the provisions which must be made for extreme low water and high water conditions, which in turn depend upon the nature of the load to be served. As the chapters relating to the prospective market plainly indicate, this project must depend for success largely upon electro-chemical industries. For such industries an occasional sacrifice for a few days or even weeks, at intervals of a few years, is usually to be preferred over the increase in the purchase price of power which would be made necessary by the installation of steam or other auxiliary power to care for the deficiency during low water, or the installation of extra generating units to care for the deficiency during floods. Extremes of high or low water will therefore be ignored to a degree depending upon their frequency and duration, except where they affect the safety of a structure.

In Appendix B it is shown that the probable frequency of the 1894 flood is only about once in 1000 years, which figure although not numerically dependable, nevertheless indicates that it is such a remote contingency that it may be ignored in choice of controlled headwater elevation, assuming that in such an event a sacrifice in station capacity or even a total shutdown might better be borne. Neither would damage to property caused by a repetition of the 1894 flood be chargeable to the power project, provided the controlling works of the proposed power development did not raise the water at the damsite above its elevation in 1894.

Although such an infrequent flood as 1894 can be ignored in so far as its occurrence might interrupt the operation of the station or reduce the revenue, yet the case becomes quite different when we consider the design of the flood controlling works. These works must be designed to care for some margin of safety over the highest flood on record to provide for a possible flood of greater magniture, for inaccuracies in the hydraulic coefficients used for the design of spillway, and for inaccuracies in the records of flood stages upon which these designs were based.

Limiting flood. From Fig. 4 (p. 373, Nov. 13, 1915) a radical difference will be seen in the flood characteristics prior to, and since 1894. It will be observed that during the past twenty years, or since the 1894 flood, no annual flood has reached a value as large as 800,000 second feet, although prior to this period this flood was exceeded nine times in a record of thirty-seven years, or about one in four years, the average frequency in the entire fifty-seven years of the record being about once in six and one-third years, whereas it was shown in Appendix B that the probable frequency of this flood is once in five years. This flood has been adopted for this report as the limit to which full station capacity need be maintained and will be discussed in greater detail in Appendix E.

Head control program. The program of head control tentatively recommended is shown in Fig. 20, platted with relation to river discharge horizontally. All curves are shown for the known range of the river and are also extended to a flood of 1,400,000 second feet, or about 20 per cent above the flood of 1894.

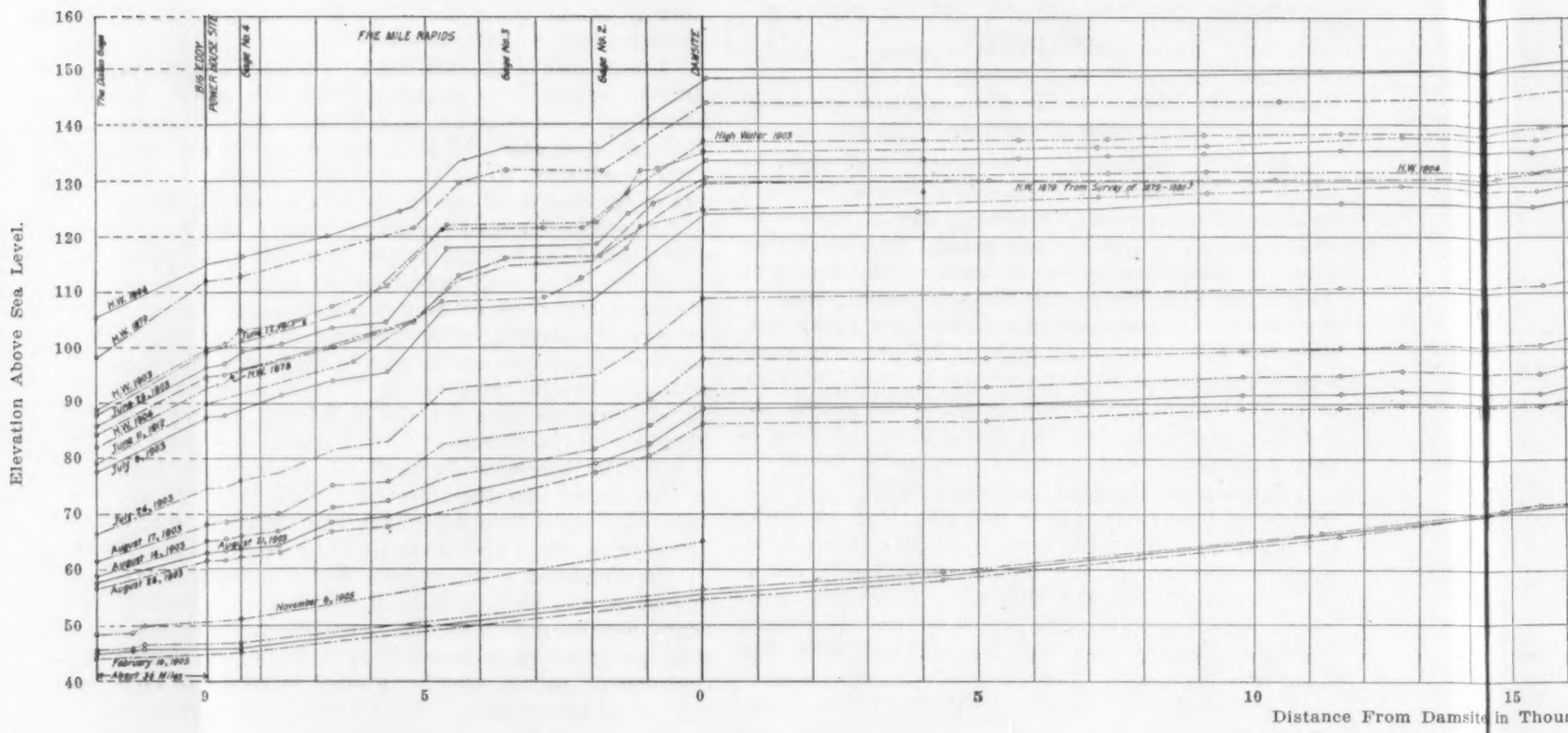

Fig. 21. River Profiles From The
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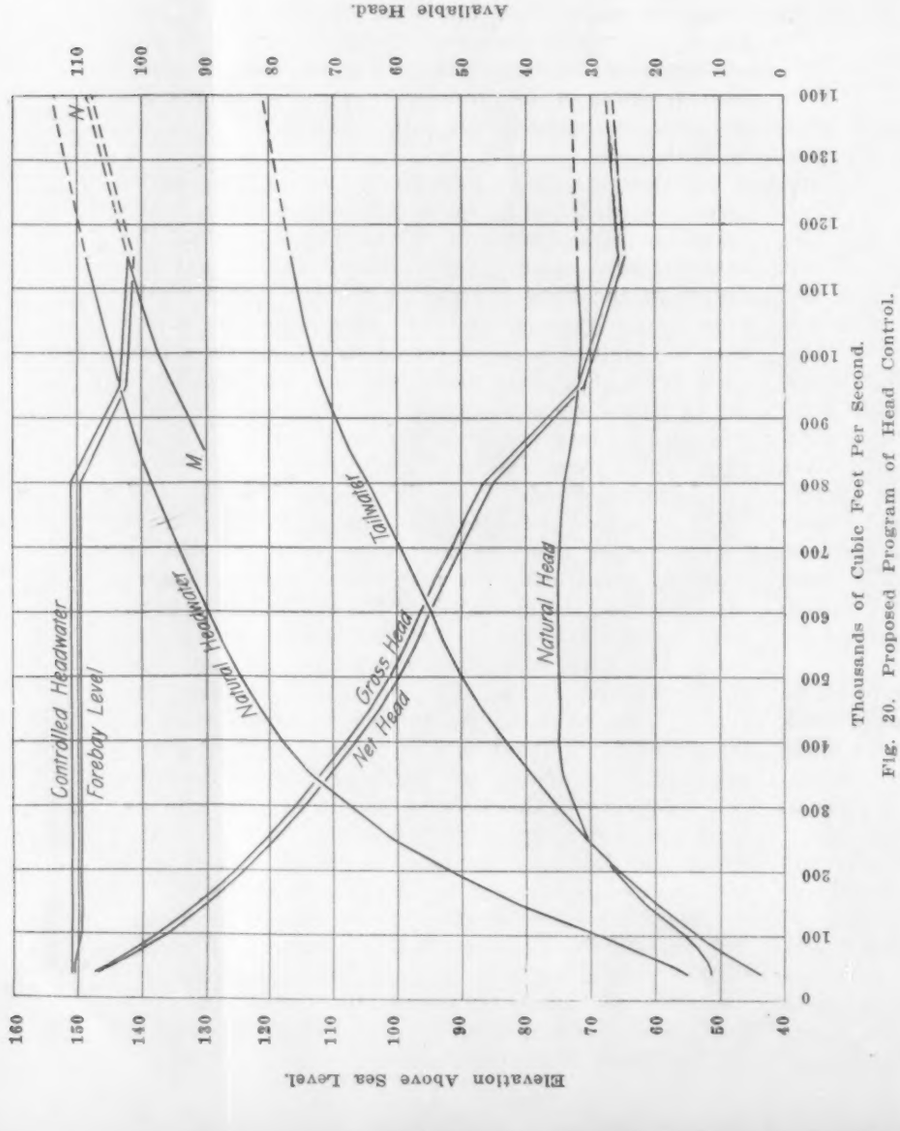


Fig. 20. Proposed Program of Head Control.

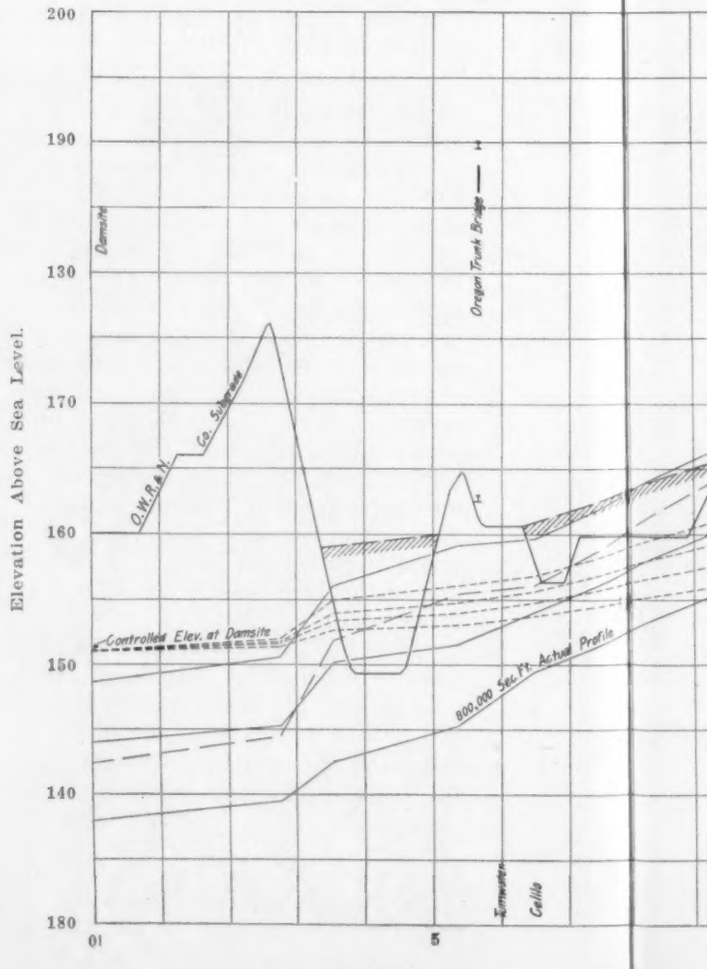
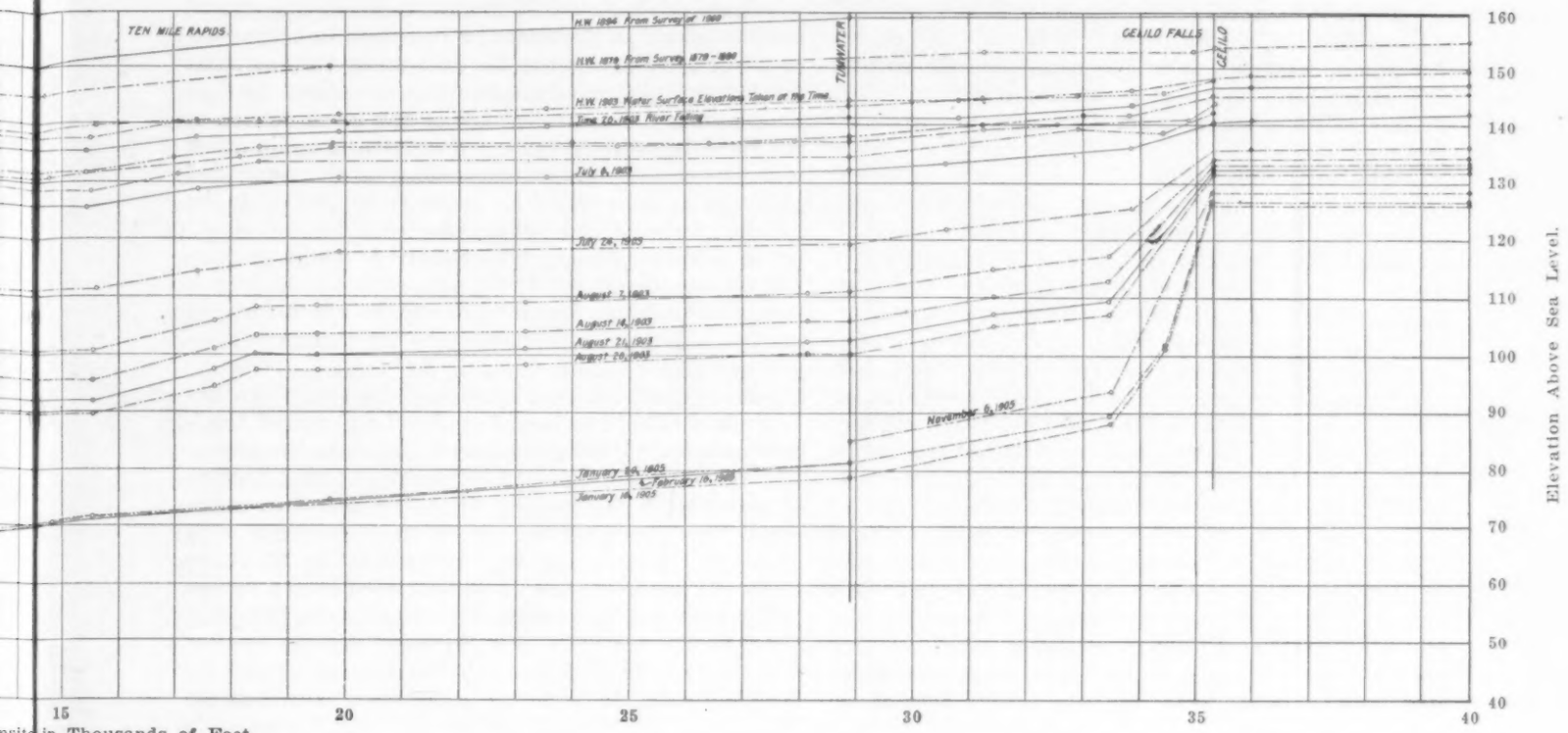


Fig. 22. Calculated River Profi



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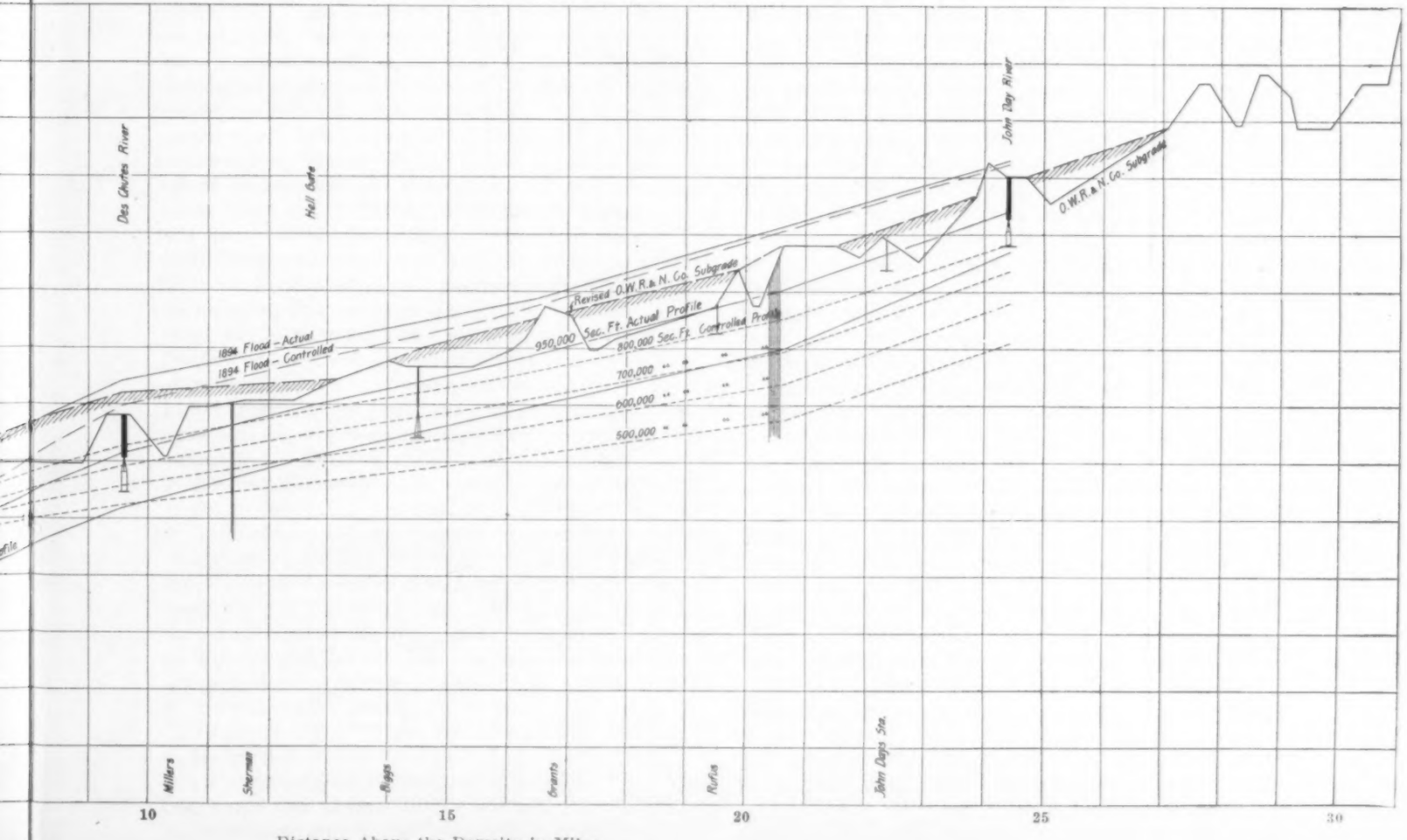


Distance Above the Damsite in Miles.

River Profiles for Controlled Elevation, 151.0, Showing Relation to O.-W. R. R. & N. Co.'s Present and Proposed Profile.

Curves of natural headwater and tailwater level and their difference, or the natural head, are also shown for general interest. It will be noted that the natural fall varies from about 11 ft. at low stages to about 35 feet at mean stage, again decreasing slightly during high floods.

The headwater at the dam is shown controlled to a constant elevation of 151.0 for all discharges below 800,000 second feet. This elevation is only 2.4 ft. higher than the flood elevation of 1894, and for this reason it would not increase the height to which all dams and controlling works would otherwise need to be built. A lower controlled level for this reason would not decrease the cost of such works and is not to be recommended from this standpoint. From 800,000 second feet to a flood of 950,000 second feet the headwater is assumed to be lowered uniformly until at the latter flood the natural elevation of the river at like discharge is reached. This latter flood was shown in Fig. 18, (p. 482, Dec. 25, 1915), to have a probable frequency of once in 25 years. Above this flood the gates are opened to lower the river below its natural level for the benefit of property upstream from the dam, until at 1,170,000, the 1894 flood, the line "MN" is reached, which is the line of headwater variation with all flood gates entirely open. For larger floods, should they ever occur, the water would again begin to rise along the line "MN" until, at 1,400,000 second feet, the natural level of the 1894 flood would be reached. The difference in elevation between the "controlled headwater" and forebay curves represents the drop in the 9000 ft. of power canal.

Controlled head. The tailwater curve shown in Fig. 20 is not in general subject to control and the head is therefore obtained by subtracting its elevation at any discharge from the corresponding elevation of headwater. Two curves thus obtained are shown, one representing the gross available head and the other the net head after deducting the loss in the power canal.

It will be noted that with the program of head control there indicated, a maximum net head of 107 ft. would be available at the extreme minimum flow of 41,900 second feet, the head falling off rapidly to about 105 ft. at the assumed usual minimum flow of 50,000 second feet, 45 feet at 800,000 second feet, thence to about 31 ft. at 950,000 second feet and 25 ft. at 1,170,000 second feet and above.

Backwater studies. The limiting headwater elevation of 151 ft. was selected by means of a study of the backwater curves for floods of various magnitudes and controlled elevation at the damsite. The available data permitted the computation of these curves with an unusual degree of accuracy. This was made possible because it is proposed to limit future floods to an elevation not greater than that of 1894. The controlled fluctuations in water level at all points except immediately at the damsite would thus be within the range of observed stages of the river and below the elevations of existing flood records of known magnitude. It was therefore possible to determine for any given controlled elevation and flow at any point along the river the natural flow of the river when at this elevation and the natural corresponding fall through the stretch considered. The natural fall in this stretch of river was then decreased or increased in proportion to the relative squares of the flow under consideration to the natural flow at the assumed elevation. In thus determining the controlled fall of any given stretch of the river, the natural fall could be used in conjunction with the natural flow corresponding to the controlled elevation at the upper end, at the lower end or at the middle of the stretch by a process of successive approximations. The middle elevation would theoretically be best, but the upper end was used because it furnished a small factor of safety to allow for any change in hydraulic constants with the change in slope and velocity.

Very complete gage records of the river from Big Eddy to Celilo have been kept by the Corps of Engineers, U. S. A., during the investigations and construction of the Celilo Navigation Canal. Several profiles of this stretch of the river, from low water to maximum flood, traced from one of their drawings with necessary change in datum, are shown in Fig. 21. Above Celilo the low water profile was obtained from a survey of the Corps of Engineers, U. S. A., made in 1905; the flood profile for 1914 was observed by the project field party who also observed high water marks for 1913 and collected sufficient information regarding the 1894 flood to establish its profile with reasonable accuracy. These four profiles, which are shown in Fig. 5, made possible the platting of curves showing the relation of discharge to elevation at frequent intervals along the river from Celilo upward, each curve having at least four fairly trustworthy points; below Celilo similar curves were platted from Fig. 21 with a higher degree of accuracy than attainable above. The positions of these curves formed the division points between the successive stretches and the curves themselves furnished the data for the backwater computations. In Fig. 22 are shown the computed backwater curves for 500,000, 600,000, 700,000 and 800,000 second feet with a controlled elevation at the damsite of 151 ft.; also the natural profiles for 800,000 and 950,000 second feet and for the 1894 flood.

As outlined in Fig. 20, the proposed program of head control provides for some raise in water level above its natural elevation for all floods up to 950,000 second feet, and for this reason some occasional damage to agricultural property and to railroads would occur up to this limit. Although this flood is a very remote contingency and much damage would occur in that event even under natural conditions, yet it has been thought best for safety in estimates to assess the entire railroad reconstruction and purchase value of damaged lands to the power project, even though damage would occur only at intervals of several years and would not prevent the continued use of these lands. In this connection it should be said that only a very small amount of agricultural land would be affected, as the river banks up to the controlled elevation throughout most of the distance consist only of sand dunes and basaltic lava rock.

The O-W. R. & N. has been assumed as raised at each point where necessary to a safe clearance above the higher of either the 800,000 second feet controlled profile or the 950,000 second feet natural profile.

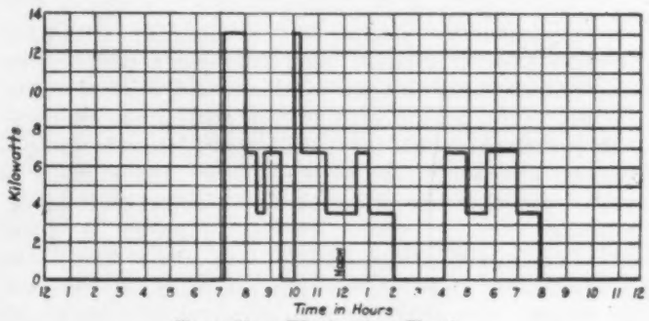
All recommendations as to the head to be adopted in order to be final, would necessarily be based upon comparative studies of the economy and unit cost of power for several assumed schemes of development and adopted headwater levels. It early became evident that neither time nor funds would be available for such comparative study and that the work would need to be limited to a fairly complete study of that scheme of development which might appear from general indications to be the most desirable and economical. The program of head control above outlined and used throughout this report must therefore be considered tentative.

In this chapter the natural conditions, chiefly the property damages, have been considered as limiting the available head. In the chapter on "Flood Control" the limits imposed by considerations of practicability of dams and controlling works will be discussed, and in the chapter on "Available Power" the practicability and economy of machinery for this wide range of heads will be considered.

ELECTRIC BAKE OVENS AT SALT LAKE CITY.

BY BAYARD W. MENDENHALL.

Early this year, the Salt Lake office of the Utah Power & Light Company became convinced that there was an excellent field there for electric bake ovens. They accordingly ordered a Hughes No. 150-36 loaf oven from the Hughes Electric Heoating Company of Chicago, with the intention of trying it out and learning what merits, if any, electric baking had over the ordinary method. Early in April this oven was installed for a demonstration on the sales floor of the United Grocery Company, who were making at that time a special demonstration of flour, cake and other baked products. While the oven was installed there, several of the bakers and restaurant operators were taken to witness its operation. Mrs. Walden, in charge of the delicatessen department of the United Grocery, who had charge of the demonstration, spoke in the highest terms of the work done by this oven. Mr. C. A. Shay, proprietor of Shay's Cafeteria, ordered a No. 200 Oven —72-loaf capacity, for use at his cafeteria. This installation has been perfectly satisfactory. Mr. Shay states that the electric oven has cost him 20 per cent less to operate than the gas oven, which it replaced and that



Recording Wattmeter Chart.

he is able to turn out more products with his electric oven. The power company recently installed a recording wattmeter on this installation and kept a record of the maximum demand and consumption daily. The following is a summary of the results secured between October 7th and 29th while the recording instrument was in use.

Connected load rated	12 kw.
Maximum demand during period	13.4 kw.
Average maximum demand	13.2 kw.
Average daily consumption	65.67 kw-hr.
Load factor for period	20.40%
Load factor for the 13 hours in use	38%

The average weekly output of materials during the period covered by this test is as follows

700 Pies.	100 lb. Veal.
40 Loaves Nut Bread.	160 lb. Pork.
200 Loaves White Bread.	10 doz. Cream Puffs.
36 Loaves Raisin Bread.	10 doz. Patties.
38 Cakes, 1 layer, 10 in. diameter.	52½ doz. Rolls.
37 Cakes, 1 layer, 8 x 12 in.	17½ doz. Biscuits.
270 lb. Chicken.	16 Meat Pies, 15 x 20 in.
14 pans Common Bread, 15 x 20 in.	

The results of the demonstration also convinced Mr. Geo. Mueller of the Royal Baking Company of the superiority of electric baking and he ordered a No. 200 for use in his pastry department, which was installed in June. This oven has been so satisfactory that he has ordered another No. 150 36-loaf Hughes oven for use in his cafeteria kitchen for roasting meats and another No. 220 Hughes oven—120 capacity, to be used in his pastry department. He states that if this latter oven proves to be what he wants, as to size and arrangement, he will order a duplicate of it which will make four ovens, aggregating a connected load of 42½ kw., when the installation as now contemplated, is completed.

Several other ovens were sold shortly after as a result of the success of the first installation, including a No. 200 for Hart's Lunch Room, a No. 200 for Spary & Mehse, a No. 200 for the Package Grocery, a No. 200 for the Palace Market and a No. 200 for the Consolidated Grocery Company.

At the time the demonstration was made for the United Grocery Company, they were not in a position to consider the purchase of an oven. Recently, however, Mr. Smith, the manager, has purchased two No. 150 Hughes ovens and is preparing to make an installation which will be the finest advertisement for electric cooking and baking which it could possibly receive. These ovens will be located in a special department on the sales floor of their store and all of the pastry, cake and other products sold in their delicatessen department will be prepared and baked in the electric ovens in full view of the patrons to the store. They intend to make a special feature of the fact that their products are better because they are baked electrically. The store is now being remodeled to accommodate this department and the installation will be made the latter part of November.

We give herewith a tabulation of the consumption by months of the bake ovens now installed:

Name.	Make Oven, Hughes No.	Max. Demand.	Average Daily Hr. Use.	K.W.-Hr. Consumed. May.	Jun.	Jul.	Aug.	Sep.	Oct.
Royal Cafe	200	9	9		257 15 dys.	742	813	1139	1215
Royal Baking Co.	150	4½	9						197
Shay's Cafeteria.	215	12	13	1072 15 dys.	2056	2058	1846	2039	2101
Hart's Lunch Rm.	200	9	13			1770 9 dys.	1759	1713	1402
Sparey & Hehse.	200	9	11			375	1533	2105	2005
Package Grocery.	200	9	9					401 15 dys.	1512
Palace Market	200	9	9						625
Con. Grocery	200 2.2 kw. Hot Plate.	9							1180

It will be seen that these ovens afford a highly desirable character of load and produce a most satisfactory revenue.

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A National Water Law

A special committee of the American Society of Civil Engineers has been quietly at work for two years and a half on suggestions for a proposed national water law. This committee was appointed in accordance with a resolution submitted on May 7, 1913, by Mr. John H. Lewis, state engineer for Oregon. Its duties were to prepare a preliminary draft of a law "applicable to all navigable, interstate and other waters within the jurisdiction of the United States." The committee's progress report is to be submitted at the annual meeting of the Society on the nineteenth of January.

The report states that the enactment of a comprehensive law is now impossible, as Congress is restricted by the lack of constitutional authority. Furthermore the committee feels that engineers in general should have an opportunity to discuss certain fundamental principles which are laid down as a guide for any future legislation.

These principles seem in many respects to be the most enlightened and comprehensive suggestions as to a national water policy which have yet been formulated. They are predicated upon the assumption that the "highest economic use of water" is paramount to any question of whether the utilization be accomplished through private or public enterprise. This means, as far as the West is concerned, that domestic requirements, irrigation and power purposes, take precedent over navigation. The former add more to the wealth and welfare of the community and should consequently be given the preference.

The recognition of the relatively greater importance of irrigation over navigation is a point which unbiased and far-sighted engineers of the Pacific Coast have long recognized. This point is another of the long list of conditions which make the West different from the East. Heretofore the navigation interests have been successful in their opposition to the needs of irrigationists. Irrigation enterprise has consequently been greatly hampered in order that unused transportation facilities be provided. Now that powerful railroad commissions have eliminated the need for possible navigation as a club over railroad rates, irrigation should be given an opportunity for development.

The present federal laws regarding navigable streams were framed to meet conditions which have long since been changed. River navigation is conducive to the least good of the least number as compared with the benefits which accrue from the irrigation of semi-arid areas in the West. Therefore it is high time that the inadequacy of existing laws be remedied.

The investigations of this committee have also demonstrated that the restrictive policies of the past as regards the utilization of water should be abandoned so as to do away with the present stagnation in hydraulic developments. Unlike many other natural resources, water is best conserved when most completely utilized. Non-use is waste.

But above all else, the committee recommends local administration of water laws. "Much of the legislation required for the best utilization of the water resources of the country must of necessity

originate in the states rather than in the general government." The laws of the various Western states should be unified and then Congressional action should conform with them.

The federal government is manifestly within its prerogatives in making laws for interstate streams, these being the subject of the committee's investigations as regards a national water law. Their code of principles stipulates that each river system should be considered as a natural unit, regardless of political boundaries. "First in time is first in right" should govern past rights on interstate streams and "the highest economic use" should dictate future appropriations.

But no matter whether interstate or intrastate beneficial use should be "the basis, the measure and the limit of the right to the use of water."

Electro-Chemical Developments

The Naval Consulting Board has recommended that the government establish a plant for the manufacture of nitric acid from atmospheric nitrogen. By this recommendation the question thus becomes of public rather than of private interest. Where public preparedness requires an insurance of an ample supply of nitrates for the manufacture of powder, the usual deterrents to private investments are removed. Where private capital would hesitate to invest in an electric plant for the fixation of atmospheric nitrogen, the expense and even possible loss would not forbid governmental experiments.

Another hindrance to private operation is the probable opposition from surrounding land-owners due to the destructive effect of the escaping nitrous fumes on vegetation. The case is analagous to the sulphurous acid fumes from the copper smelters, concerning which there has been so much expensive litigation initiated by the farmers.

In this connection it is of interest to note that the report of the commission appointed to investigate alleged damage from the Selby smelter. (Bulletin 98, U. S. Bureau of Mines) concludes that the smelter does not maintain a nuisance and that the gases have no objectionable odor or disturbing physiological effects upon the mucous membrane linings of the throat and lungs of human beings and domestic animals. This result was attained by the smelter, however, only after years of expensive experiment and litigation. Like the inductive interference controversy, it demonstrates the superiority of science over law in adjusting difficulties.

While it has been possible for a few small-minded men to thus hold up a private enterprise which produces far more wealth than could ever be grown on the surrounding farms, no such likelihood is to be anticipated in the case of a government munition plant.

In Germany the private nitrate plants have been taken over by the government. In case of war similar action could be expected in this country. So it is not to be a subject of wonderment that private capital has hesitated to entrust its monoplane to the shifting currents of air nitrate manufacture.

Another more attractive electro-chemical industry is the manufacture of caustic soda. During the past week announcement has been made of the formation of a big corporation to utilize the abundant salt and limestone supply in the vicinity of San Francisco bay, together with cheap electric power, for the manufacture of caustic soda, bleaching powder and various by-products. As the plans call for an initial consumption of twenty-five hundred electrical horsepower, another outlet will thus be provided for the utilization of hydroelectric power.

The manufacture of paper from wood-pulp, the reduction of potash and aluminum from feldspar and the preparation of graphite from waste lamp-black are attractive electro-chemical projects which will probably be realized in the near future on the Pacific Coast.

The Reward of Service

Action and reaction are equal and opposite. This fundamental principle is no truer in its mechanical meaning than in a human sense. Newton's third law of motion is but a specialized expression of Nature's first law of service. Service rendered is an action, reward obtained is the reaction. No employe can exert a weak action of service and expect a strong reaction of pay; nor can any employer ignore the law of service and escape the payment of the penalty.

The thought is equally applicable to the individual worker and to the public service corporation. It is only a positive recording of the more passive statement "it is better to give than to receive." Every man is, in a sense, a telephone instrument, equipped with a transmitter and a receiver. It is only by constant use of the transmitter of service that there can be any return in the receiver.

Stated otherwise, this means that to get you must first give. This is well exemplified by the fact that the teacher learns more than the pupil. Furthermore, the less thought of reward in rendering service, the greater the pleasure of the reward received.

Service embodies the thought of each for all. It is the antithesis of that pernicious doctrine, "every man for himself and the devil take the hindmost." True service removes competition, except that desirable form of competition with one's self, whereby a man endeavors to make his present excell his past.

These are the thoughts which should actuate the salesman in selling goods for his house, the house in catering to its customer, and the customer in serving the public. To give is the best way to get, just as to forgive is the best way to forget. What you put in is a direct measure of what you take out. True success is a by-product of a life of service. When service ceases success flits. Like happiness no man can attain it if it is the one object sought. It comes from a forgetfulness of self in working for others. It is the result of giving, not of getting.

PERSONALS

Wm. Ford, electrical expert for the Railroad Commission of San Francisco, has just returned from a business trip in the south.

W. W. Beckett, of the New York office of the Stone & Webster Construction Company, is a recent arrival on the Pacific Coast.

B. M. Atkins has been appointed by the North Coast Power Company as district manager for Southwest Washington, with headquarters at Kelso.

B. J. Klein, Pacific Coast manager of The Bristol Company, Waterbury, Conn., has just returned to San Francisco from a short business trip to Los Angeles.

C. V. Schneider, electrical contractor of Sacramento, Cal., and president of the Electrical Contractors' Association of California, was a recent visitor at San Francisco.

J. B. Lukes, Pacific Coast manager of Stone & Webster Construction Company, expects to return to San Francisco about the end of the month from Texas, where he has been for the past month.

Albert Kramer, a recent graduate from the apprentice's course of the Westinghouse Electric & Manufacturing Company of East Pittsburg, Pa., has now joined the sales forces of the San Francisco office.

Wynn Meredith, member of the firm of Sanderson & Porter, San Francisco, Cal., expects to leave for New York about the end of the week to attend a conference with the officials of his company there.

C. F. Conn, manager of the San Francisco office of J. J. White & Co., recently left for New York to attend an annual meeting of that company, and is expected back at San Francisco about the 15th of the month.

Herbert I. Markham, general manager of the Federal Sign System (Electric) of Chicago, leaves that city on January 7th for an extended trip throughout the Western territory in company with **I. W. Simpson,** western district manager of San Francisco.

W. S. Hanbridge, formerly secretary of the Electrical Contractors' Association of California, has opened an electrical supply house at San Francisco. **J. W. Redpath,** formerly with the Technical Publishing Company, has succeeded Mr. Hanbridge as secretary of the Association.

J. B. Edwards has been elected president of the Kellogg Switchboard & Supply Company, and will also continue as general manager, a position which he has filled for the past ten years. **L. D. Kellogg,** the retiring president, has been elected chairman of the board of directors.

O. P. McCord, formerly sales engineer of the Westinghouse Electric & Manufacturing Company of San Francisco, has recently severed his connections with that company and has joined the sales forces of the Electric Railway & Manufacturers' Supply Company at San Francisco.

F. A. Easton, who has been in charge of the San Joaquin Light & Power Corporation's San Luis Obispo district for the past year, has been given charge of an electric range campaign which will cover the company's entire territory. **D. P. Mason,** formerly chief store keeper, has succeeded Mr. Easton at San Luis Obispo, Cal.

Knud Jensen, buyer for the Angel Muzzio and Hijos Electrical Importing Company of Buenos Ayres, is at San Francisco. Mr. Jensen states that his concern had previously imported most of the modern electrical appliances from Germany and some few from Italy, but that war conditions had given American manufacturers the whip hand. The South American visitor has been commissioned by his firm to place orders amounting to $250,000 in the United States.

OBITUARY.

William Clafiin Andrews, advertising manager of the Edison Storage Battery Company, Orange, N. J., died in New York City on December 21st. A graduate of Columbia University, Mr. Andrews afterward became sales engineer of the Stanley Instrument Company of Great Barrington, Mass., and later became connected with the General Electric Company in Schenectady, N. Y., and Harrison, N. J. He was for two years secretary of the Rae Company, New York City, leaving to join the Edison Storage Battery Company in April, 1913, where he was advertising manager until his death. Mr. Andrews enjoyed an unusually large acquaintance among electrical men, and was particularly active in the Electric Vehicle Association of America and in the Jovian Order, of which he was Statesman-at-large for New Jersey.

HOUSEWARMING AT ENGINEERS' CLUB, SAN FRANCISCO

The Engineers' Club of San Francisco celebrated the completion of its new home on the top floor of the Mechanics' Institute Building, by a dinner and Christmas tree celebration on Wednesday evening, December 29th. As nearly one hundred and fifty members were in attendance the new quarters were taxed to their capacity. During the dinner, W. W. Briggs, as toastmaster, introduced several entertainers to amuse the crowd and also called in more serious vein on C. C. Merrill and A. H. Babcock as past presidents to tell of the origin of the club and its accomplishments.

As junior past-president Mr. Briggs told of the efforts which had lead up to the present prosperous situation of the club. E. B. Bumstead, president-elect, extended hearty welcome. Brief remarks were also made by the presidents of the Commonwealth Club and of the Transportation Club.

Santa Claus, personified by Eli Hutchison, then jovially distributed gifts from the electrically-lighted tree to every one present. Each gift carried with it some humorous remark and was fully in accord with the spirit of the occasion.

The members then adjourned from the dining room to enjoy the comforts of the lounging and card rooms, remaining until a late hour. The entire assemblage voted the affair a great success and a credit to Wynn Meredith, chairman of the entertainment committee.

Lounging Room in San Francisco Engineers' Club.

The accompanying view gives an idea of the beautiful manner in which the quarters are furnished. Their convenient situation, combined with the excellent culinary service should make membership in a club a most desirable thing. The organization has been most successful, having 237 resident members, a large non-resident list, and "money in the bank."

MEETING NOTICES.

Coming Conventions of A. I. E. E.

At the meeting of the board of directors of the American Institute of Electrical Engineers, held December 10, 1915, it was decided to hold the usual Midwinter Convention in New York City, on February 8-9, 1916.

At the same meeting a Pacific Coast Convention, to be held in Seattle, Wash., under the auspices of the Seattle Section of the institute, was authorized, the date to be decided later. The programs of these conventions will be announced later.

Portland Sections A. I. E. E. and N. E. L. A.

The regular bi-weekly luncheon was held December 23, 1915, the attendance being 75. The speaker of the day was W. M. H. Galvani, civil engineer for the Pacific Power & Light Company. His subject was "Preparedness." His remarks were along the "Universal Peace" ideas. A Christmas present was given to each member present with the understanding that the package containing same had to be opened in the presence of the other members of the luncheon. This occasioned a great deal of fun, especially when a "bald-headed" man received a "curling iron."

Jovian Electric League of Southern California.

The final luncheon for the year 1915, held by the league at Christopher's, on December 29th, was marked not only by a large attendance, but a spirit of jollification and good fellowship, entered into by every one present and due, no doubt, as largely to the wit and enthusiasm inspired by the acting chairman, Allan E. Morphy, and the chairman of the day, Harry N. Sessions, as the natural effects of this season of the year. In the absence of President Holland, Vice-President Morphy reviewed the year's work of the league and earned for himself the gratitude of the treasurer, even if that of no other member by the imposition of exceptionally heavy fines, which contributed over forty dollars to the greatly overworked treasury. But, after all is said and done, his inimitable wit largely outweighed this "imposition." Harry Sessions certainly made "good" when he coaxed the Costello girls to sing Spanish songs and dainty Miss Geisler to render a few clever ballads. The big treat of the day, however, was the reading by Benjamin F. Pearson, the greatly beloved superintendent of the Southern California Edison Company, of his very beautiful and poetic bit of prose, entitled "The Snow Flake in Industry."

Oregon Irrigation Congress.

The fifth annual session of the Oregon Irrigation Congress was held December 28, 29, 30 at the Imperial Hotel, Portland. The Jones bill was the chief topic for discussion, full endorsement being given to its provisions.

John H. Lewis, state engineer, presented a paper on "Meritorious Irrigation Projects as Shown by Co-operative State and Federal Surveys," wherein a brief description was given of the several Oregon projects, upon whose features reports have been made, Deschutes, Ochoco, Silver Lake, John Day, Malheur, Owyhee and Harney. He recommended that experiment stations be established to solve the marsh land problems.

Leonard Lundgren, district engineer, U. S. Forest Service, spoke on "Government Rights of Way for Oregon." After tracing the evolution of the Forest Service, he explained the necessary procedure in acquiring rights of way for irrigation projects.

Judge Carroll S. Graves of Seattle spoke on "Irrigation District Laws," urging some sort of federal aid in financing them. In this connection he explained the salient features of the Jones bill.

L. M. Rice, irrigation engineer at Seattle, read an address on "Construction Engineering," wherein he urged that engineers be of public service in encouraging the conservation and use of water for irrigation.

Other addresses were given by Governor Withycombe, E. G. Hopson, E. G. Young, Geo. M. Brown, O. Laurgard, J. T. Hinkle, I. N. Day, J. W. Kerr, J. A. Keating, R. D. Hetzel, Porter J. Neff and Arthur Hooker.

J. W. Brewer of Portland was elected president, F. N. Wallace of Tumalo secretary and H. H. De Armond of Bend, A. D. Anderson of Madras and C. C. Clarke of Arlington, vice-presidents. Resolutions were adopted endorsing state aid for irrigationists.

CALIFORNIA WATER COMMISSION APPLICATIONS.

Bridget Graham of Colusa has made application to the commission for a permit to appropriate 31 second feet of the waters of Sacramento River at a point in the NW. ¼ of the NW. ¼ of Sec. 5, Tp. 16 N., R. 1 W., M. D. M. A 100 h.p. motor connected to a 20 in. centrifugal pump, a 30 in. steel pipe to the river, with a system of ditches, furnishes the method of diversion. The plant is intended to irrigate 1100 acres and the estimated cost is $5500.

Samuel P. Hale of San Jose has made application to the commission for a permit to appropriate 40 second feet of water from Jackson and Hale Creeks, in Fresno county in Secs. 34 and 35, Tp. 16 S., R. 13 E., M. D. M. His dam of earth and concrete is estimated to cost $1000. The system is designed to water 345 acres.

W. H. and J. S. Garrison of Victorville have asked for a permit from the commission to appropriate 50 miner's inches of water from Crystal Creek in San Bernardino county, for purposes of irrigation. There is a pipe line one and one-half miles long in the diversion plan. Location Sec. 1, Tp. 3 N., R. 1 W., S. B. M.

James Poindexter and John L. Davis have applied to the commission asking for a permit to appropriate 120 acre feet of water from Dry Ravine, tributary to Goose Lake, Modoc county. Their storage dam will be of earth and cost about $200. A ditch a mile and a half long will convey the water to the land. The applicants are residents of Davis Creek.

J. A. Baxter of Independence, Inyo county, has asked permission of the commission to appropriate 40 miner's inches of water from Nine Mile Creek in that county, and by a pipe line four and a half miles long convey the water to his lands. He has a concrete diversion dam and ditch in his plans.

H. H. Gable of Esparto, Yolo county, has applied to the commission for permission to use the waters of Oat Creek, a tributary of the Colusa Basin, to the extent of 80 miner's inches. There is no main canal, the water to be stored in a reservoir until there is enough for a day's run for an eight inch pump, which will throw it into the distributing ditches. The dam will be of reinforced concrete, with 54 sq. ft. of openings to discharge the flood flow. The estimated cost is $1600, and there are 160 acres to be irrigated.

The Sutter Butte Canal Company of Gridley has applied to the commission for permission to appropriate waters to the extent of 50 second feet from Hamilton Slough, tributary to Butte Creek in Butte county. The waters applied for are those which escape from drainage of lands irrigated by the same company's system, which flow into Hamilton, Henderson and two other unnamed sloughs. It is intended to install removable dams, which can be taken out in the period of flood flow. A pumping plant will be used in connection with this proposed diversion, which contemplates the irrigation of 8000 acres.

A. G. Clausen of Alturas, Modoc county, has filed his application with the commission asking for permission to appropriate 50,000 acre feet of the flood waters of Rattlesnake Creek in that county, tributary to the Pit River. The proposed diversion is for irrigation of some 20,000 acres of land and the works are to be known as the Big Sage Irrigation System. It calls for a storage dam 40 ft. high, 500 ft. long and 20 ft. wide on top, built of earth and stone with a concrete core.

Manuel Garnier and Fred Osborn of Doyle, Lassen county, have applied to the commission for permission to appropriate for purposes of irrigation 25 second feet of the waters of Long Valley Creek. The estimated cost of diverting the water to 400 acres to be irrigated is $3000.

Leon Bly of San Francisco has made application to the commission for permission to appropriate 30,000 acre feet per annum of the waters of Eagle Lake, Lassen county, which sink into the ground, carrying the water by means of a tunnel and canal to the natural channel of Willow Creek, from which the water is again reclaimed, turned into the bed of Susan River and again taken out and used to irrigate lands at the north end of Honey Lake Valley. The tunnel is to be 3880 ft. long, connecting with the canal 5933 ft. in length. Eagle Lake is characterized as a sink with an area of 29,000 acres. The application sets forth that between 1875 and 1915, the level of the lake had raised fifteen feet. It is proposed to tap the lake with the tunnel 11 ft. below the level and lower the lake eight feet, which with the annual average supply will furnish about 14,000 acre feet of water. The tunnel dimensions are given as six feet wide top and bottom and four feet deep at the headgate. The canal is given as 11 ft. wide on top and 7 ft. on bottom with depth of water, 4 it. The elevation of the lake is 5000 ft. and the application states that it will take all of the open season of 1916 to complete data and that it will be impossible to commence construction work before June, 1917, and that on account of the short open seasons the work of construction would consume an estimated period of three years.

W. J. Browning of Grimes, Colusa county, has applied to the commission for permission to appropriate for agricultural purposes, waters from the source of Butte Creek, waters of overflowed lands tributary to it and waters from the drainage of irrigated lands which find their way into the creek. His point of proposed diversion is near the center of Sec. 17, Tp. 18 N., R. 1 E., M. D. M., in Butte county. By a diversion dam and canal he proposes to irrigate 320 acres.

The White and Friant Lumber Company of Chicago have applied to the commission for permission to appropriate 1000 miner's inches of the waters of Whiskey Creek, a tributary of the North Fork of the San Joaquin River, the point of proposed diversion being located in the NW. ¼ of Sec. 34, Tp. 7 S., R. 23 E., M. D. M. There is a storage reservoir to hold 500 acre feet connected with the proposed plan, the whole to be constructed at an estimated cost of $200,000. The use is for fluming and general lumbering purposes.

The Sutter Butte Canal Company of San Francisco, but operating in Butte county, has submitted to the commission three separate applications for permits to use waters in that county, the waters being, in the main, waters that drain into various sloughs from lands previously irrigated from their ditches. One application covers 50 second feet from Hamilton Slough in the above county, for the irrigation of between 4000 and 5000 acres. Another covers 20 second feet from Cherokee Canal and a third Old and New Dry Creeks. In the latter two cases, it is proposed to install pumps to reclaim the water.

M. D. Graham of Wakefield has applied to the commission to appropriate 120 miner's inches of water from Growler creek in Del Norte county for purposes of mining.

BOOKS RECEIVED.

"Overhead Transmission Lines and Distributing Circuits." By F. Kapper, translated by P. R. Friedlaender, 300 pp., 8 x10 in. Published by D. Van Nostrand Co., New York, and for sale by Technical Book Shop, San Francisco, Price $4.00.

Much can be learned from a study of methods used elsewhere. With this thought in mind this text is of interest and of value. After a brief introduction it discusses conductor materials, gives calculations for line sag and tension, shows how supporting structures are designed, brings out the influence of earth conditions on pole stability, gives many examples of pole construction and line erection, tells of line survey and gives English and German regulations for construction. American practice in general and Pacific Coast practice in particular is conspicuous by its absence. However, as an exposition of fundamental principles it brings into compact form many widely-scattered data.

TRADE NOTES.

W. C. Parish is doing the electrical work at 313½ Washington street, Portland.

M. J. Walsh & Company are rewiring the Edwards Hotel, 149 Grand avenue, Portland..

C. P. Scott is installing the electrical equipment for the St. Johns Ice Company on Division street, Portland.

NePage, McKenny Electric Company has just completed the electrical equipment of the Port of Portland's new dredge "Twalatin."

The Metropolitan Electric Company has established headquarters at 524 First Ave. South, Seattle, as manufacturers of switches, switchboards, cabinets, boxes, etc.

The Jefferson Glass Company, Follansbee, West Virginia, has reopened their plant at Millersburg, Ohio, to relieve the pressure at the Follansbee factory, and to care for the Western trade.

Standard Gas Engine Company of San Francisco has recently been appointed Pacific Coast representative for the marine Diesel type engine, built by the Southwerk Foundry & Machine Company of Southwerk, Pa.

Morrison Electric Company of Portland has the contract for rewiring the portion of the Gerlinger Building recently destroyed by fire. J. B. Stuiges is doing the electrical work at 265 Madison street, Central Garage, 235 Second street.

NEW CATALOGUES.

Hydraulic Machinery is the subject of Bulletin No. 1636 from Allis-Chalmers Manufacturing Company. This beautifully printed booklet illustrates and describes several modern hydroelectric plants where Allis-Chalmers apparatus has been installed. It also contains valuable hints on the selection of the correct type of units and details of turbine construction.

Fort Wayne Electric Works have issued two new bulletins on demand indicators. Bulletin 46102 illustrates and describes Type H, a heat-operated device of 3, 10 or 25 ampere capacity on voltage up to 500, either a.c. or d.c. Bulletin No. 46103 is devoted to Type M-2, whose demand registering element is electrically driven from the register of an independent watthour meter; the timing mechanism is a constant speed motor in a.c. instruments and a clock mechanism in the d.c. instruments.

Benjamin Electric Manufacturing Company have published a new Handy Lighting Manual, which contains a number of representative reflectors and fixtures particularly adapted for industrial lighting purposes, specialties and fittings; also a section in the rear devoted to illuminating information for the use of the lamp salesmen and engineers around plants. The articles listed are conveniently classified, the book is indexed and contains eight pages of blank ruled stock for making memoranda.

The Edison Storage Battery Company of Orange, N. J., has just issued a new bulletin on the use of the Edison nickel-iron-alkaline battery in commercial vehicle service. After enumerating some points of superiority of the electric wagon in delivery service and the effect that the Edison battery has had in increasing its simplicity, durability and reliability and in reducing the cost of maintenance and repairs and the labor attending them, the book briefly describes the construction of the Edison cell and gives examples of some of its remarkable characteristics such as long life, great mileage, ruggedness, service efficiency, cleanliness and ability to withstand extremes of temperature.

NEWS NOTES

FINANCIAL.

PORT ANGELES, WASH.—The Olympic Power Company, with offices in Port Angeles and a power plant on the Elwha River, has been placed in the hands of the receivers, who are H. E. Sims, Port Townsend, and C. L. Haggith, Port Angeles. The issues amounting to $800,000 are said to be due.

OAKLAND, CAL.—An application for the appointment of a receiver for the Oakland & Antioch Railway was filed recently in the Superior Court of Contra Costa county by Howard D. Smith and three other holders of first mortgage bonds. This suit is regarded by those guiding the reorganization plan as a block to their efforts, which have not as yet received the complete approval of the railroad commission. The charge made is that the O., A. & E. Ry.—the extension from Bay Point to Sacramento—is using the funds properly applicable to the payment of the bond interest of the O. & A.—the original line from Oakland to Bay Point—to pay its own obligations. The contention is that the debts of the "Eastern" are in this way made a senior lien on the property of the "Antioch." The complaint also charges that the Anglo-California Trust Company has become disqualified to act as trustee of the $2,000,000 bond issue of the "Antioch," by reason of loans made to the "Eastern" by the Anglo and London Paris National Bank.

INCORPORATIONS.

SEATTLE, WASH.—The Prince William Sound Water, Power, Light & Telephone Company has been incorporated here.

POCATELLO, IDAHO.—Pocatello Traction & Interurban Company has been incorporated at Pocatello, Idaho, for the purpose of installing a street railway system.

ILLUMINATION.

HEALDSBURG, CAL.—The Union Gas Company has made application to the city trustees to install a gas plant in Healdsburg.

ASTORIA, ORE.—D. S. Ewart plans to start at once the installation of an electric lighting plant at James Jamieson's ranch at Jewell.

FULLERTON, CAL.—At a meeting of the city trustees lately G. A. Lyster presented a petition requesting street lights in the southeast part of town.

SPOKANE, WASH.—The contract with the Washington Water Power Company to install an ornamental curb lighting system on Trent avenue, has been approved.

MILL VALLEY, CAL.—A communication to the trustees from the Union Gas Company indicates that the company is willing to establish a gas plant and operate it if the town of Mill Valley will lay pipes.

CULBERTSON, MONT.—Donaldson Brothers, owners of the local electric light plant, will make extensive improvements to carry additional current for street lights which are being installed by the council.

ORANGE, CAL.—A resolution of intention has been adopted by the board of trustees for the installation of street lamps on Glassell street, between Almond avenue and Maple avenue, and certain other streets.

NEWPORT, CAL.—The lighting committee recommends the completion of the city's lighting system and advises temporary lights placed from the 19th street pier to the pier on Ocean Front, and in various other places.

ONTARIO, CAL.—The city council has awarded the contract for the installation of an ornamental lighting system in West A street, between Laurel and Palm avenues, to the Granger-Hall Electric Company which was the lowest bidder.

LAMANDA PARK, CAL.—The election on the matter of forming a lighting district in Lamanda Park has been called off for two months. It is proposed to bond the district for $25,000 to be used in the installation of 224 ornamental lights.

NEEDLES, CAL.—An ordinance has been adopted granting to the Needles Gas & Electric Company the right to install and operate for a period of 50 years a system of gas pipes, electric pole line and wire system, and telephone system in this city.

SAN BERNARDINO, CAL.—Representing property owners on E street, Third to Fifth streets, W. W. Brison has presented contracts to the city council from the owners for the installation of ornamental lights, an order will be given for immediate construction.

LEWISTON, IDAHO.—County Commissioner L. J. Southwick reports that the Potlatch country and the town of Peck are to be supplied with electricity by the Kendrick Light & Power Company. The company will furnish farmers all along the route with power and light.

DOUGLAS, ARIZ.—Plans for the ornamental street lighting system to be constructed on G avenue and Tenth street in connection with paving work have been submitted to the council by City Engineer Hall. Electric current is to be purchased from the Douglas Traction & Light Company.

OCEAN PARK, CAL.—Bids will be opened at the next meeting of the council for furnishing a lighting system for Pier avenue, between the Promenade and Main street. The section included calls for 20 lighting posts with clusters of five lights each. The cost of installing the system is estimated at $1500.

PHOENIX, ARIZ.—Sealed proposals will be received at the office of the city manager until February 3d for furnishing all material and making extensions to the street lighting system of the city as per specifications on file in the office of the city electrician. Separate bids will also be received on material.

TRANSMISSION.

TACOMA, WASH.—The Puget Sound Traction, Light & Power Company will extend its lines to Ruston to furnish electric power, providing a franchise is granted.

KALISPELL, MONT.—The Mission Range Power Company has been granted right of way from the mountains east of Polson to Polson. The company has an hydroelectric plant which will supply Polson and neighboring towns with light and power.

WENATCHEE, WASH.—A survey is being made for a new power line of the Wenatchee Valley Gas & Electric Company running from the Dryden power plant to Wenatchee. Larger poles and heavier wire will be used in building the new line. The estimated cost of the improvement is $20,000. The new line will carry 33,000 volts.

PORT TOWNSEND, WASH.—Definite steps were taken by the city council toward the purchase of the Key City Light & Power Company's plant, when the city council instructed the city attorney to prepare an ordinance to submit the matter to the vote of the people. The company has agreed to sell the plant for $75,000 with $10,000 in cash and the remainder in bonds.

TELEPHONE AND TELEGRAPH.

DINUBA, CAL.—The Orosi Rural Telephone Company has appointed a committee to incorporate the company on a non-profit-sharing basis. A new telephone line will be built between Dinuba and Orosi.

COLTON, CAL.—Only one bid was received for the telephone and telegraph franchise advertised. It was from the Pacific Telephone & Telegraph Company, and that company was awarded the franchise.

STANWOOD, WASH.—The Cedarhome Farmers Telephone Company is rebuilding its system from a ground system to a metallic system. It will have 120 miles of aerial wire covering Snohomish and Skagit counties.

ALTURAS, CAL.—Jules Alexander, one of the owners of the Nevada-California-Oregon Telephone & Telegraph Company announce that a new up-to-date telephone line will be built next spring from Fall River to Alturas by way of Lookout, Adin and Canby.

SIDNEY, MONT.—The Moore Telephone Company will start at once on the construction of a telephone system from Sidney to Sioux Pass, taking in Bronson and Girard. A new exchange has been ordered for Lambert which will be an underground cable system. Next year the line will be extended from Enid to Circle via Terrace and Vida, and another line will be built from Terrace to Wolf Point. Heavy construction and extension work will be done at Sidney, Fairview and Savage.

SAN FRANCISCO, CAL.—N. N. Winter of Hood River, who has been here for some time, is working on plans to merge the existing independent telephone lines in the Northwest into a $2,000,000 concern. Among the companies that are expected to go in the merger are those at Hood River, White Salmon, Goldendale, Snohomish, Everett Sedro Woolley and Anacortes. Winter proposes to organize a company under the laws of the State of Washington, having an authorized capitalization of $200,000 in stock, with $1,350,000 of first mortgage 6 per cent 20 year bonds and $650,000 of second mortgage 5 per cent 20 year bonds. The P. S. I. T. was formerly the Farmers' Mutual Independent Telephone Company serving the rural districts of Snohomish County. When it reorganized and took over a number of smaller lines it changed its name. Winslow, the general manager, makes his home in Seattle.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The board of public works has authorized the city engineer to purchase the necessary anchor rails for the Church Street Municipal Railway line.

SAN BERNARDINO, CAL.—Work on the interlocking tower to be erected on New Magnolia avenue at the intersection of the Pacific Electric and Salt Lake tracks, will begin at once.

LOS ANGELES, CAL.—The construction of the elevated track from the Pacific Electric Building east to San Pedro street will begin within ninety days, according to Paul Shoup, president.

SANTA ANA, CAL.—A tower is to be erected at the crossing of the Santa Fe and Pacific Electric at Orange, near Santiago Creek and derailing tracks will be laid so collisions may be prevented.

SEATTLE, WASH.—The Seattle, Renton & Southern Railroad, an independent traction line which has been in the hands of the receivers for some time has at last been ordered by the court to be sold.

LOS ANGELES, CAL.—Eight of the fifteen new solid steel Pullman coaches ordered by the Pacific Electric Railway for the Covina line were put into service last week. These electric cars comprise the last word in car construction. Every car is inclosed, the smoking section upholstered, and the entire effect is very similar to the standard Pullman in use on the steam railways.

WATERWORKS.

RIDGEFIELD, WASH.—Bids will be received by the city council until January 18th for the construction of a 200,000 gallon reservoir, a pumping main, distributing mains, etc.

SAN FRANCISCO, CAL.—The board of supervisors will receive bids up to January 17th for the purchase of municipal water bonds in the sum of $2,000,000. The bonds bear interest of 4½ per cent, payable semi-annually.

LA MESA SPRINGS, CAL.—The contract between the city board of trustees and the W. D. Hall Company for the construction of the water system in El Cajon has been signed by both parties and work will begin at once.

IDAHO FALLS, IDAHO.—The trustees of the village of Ucon have applied for a certificate of public convenience for the installation of a water system for the village. The village voted a $5000 bond issue for that purpose.

SANTA MARIA, CAL.—The city trustees and officials of the Domestic Water Company have come to an understanding relative to the bond proposition and the city will soon vote on bonds for $72,500 for the purchase of the system.

WAITSBURG, WASH.—The city is planning to get a better water system. The present supply is not satisfactory and officials expect to go higher up the Coppei and get a supply on a gravity system. A bond issue will be voted in the spring.

SALEM, ORE.—An order has been issued by the public service commission directing the Coos Bay Water Company to construct a reservoir of a minimum storage capacity of 250,000 gallons in connection with its water system at North Bend.

BAKER CITY, ORE.—Bids will be received by the city clerk until January 17th for the purchase of $75,000 of the waterworks bonds, the bonds to be issued in denominations of $500 each, payable 20 years from date and bearing 5 per cent interest.

SAN RAFAEL, CAL.—Delay in commencing construction on the Marin municipal water system has been occasioned by the lack of bids for the $300,000 block of bonds offered for sale by the directors. General Manager Augustine explains the failure of the bond houses to bid by saying that they had not been given sufficient time to pass upon the legality of the proceedings. The directors, Augustine says, will readvertise the $300,000 block for sale on January 18th.

MERCED, CAL.—Plans have been finally approved by the management of the Crocker-Huffman Land & Water Company for substantial improvements in its reservoir system, which will consist in isolating the Lake Yosemite reservoir from the irrigation canal system, reserving the water in the lake for drinking purposes solely. At present, the lake is the storage place for all the water brought from the Merced River to be used for both the city water supply and farm irrigation purposes. By constructing a new aqueduct three miles long, following the course of the shore of the lake on the north side for that distance, connecting thereby the present inlet canal with the outlet canal of the lake, it will be possible to isolate the lake water from the supply intended for irrigation use.

WOODLAND, CAL.—The board of trustees have decided to submit as soon as possible the question of bonds for the extension of the water mains system of the city and the construction of a full water plant, with tank at the Grand street auxiliary plant as it now exists. To carry out the plan as outlined by City Engineer Arnold, it will be necessary to raise about $45,000. The report of the engineer contemplates two new wells, a 10 inch high pressure pump, a 150 horsepower electric motor, a 120,000 gallon steel tank to be 100 feet from the ground and the necessary accessories, the estimated cost to be $12,476. It is proposed to lay 50 feet of 12 inch pipe on Grand avenue, and 1200 feet of the same size on Lincoln avenue. Pipe eight inches in diameter and four inches in diameter will be laid in other streets.